Heating Piping & Air Conditioning

APRIL
1959

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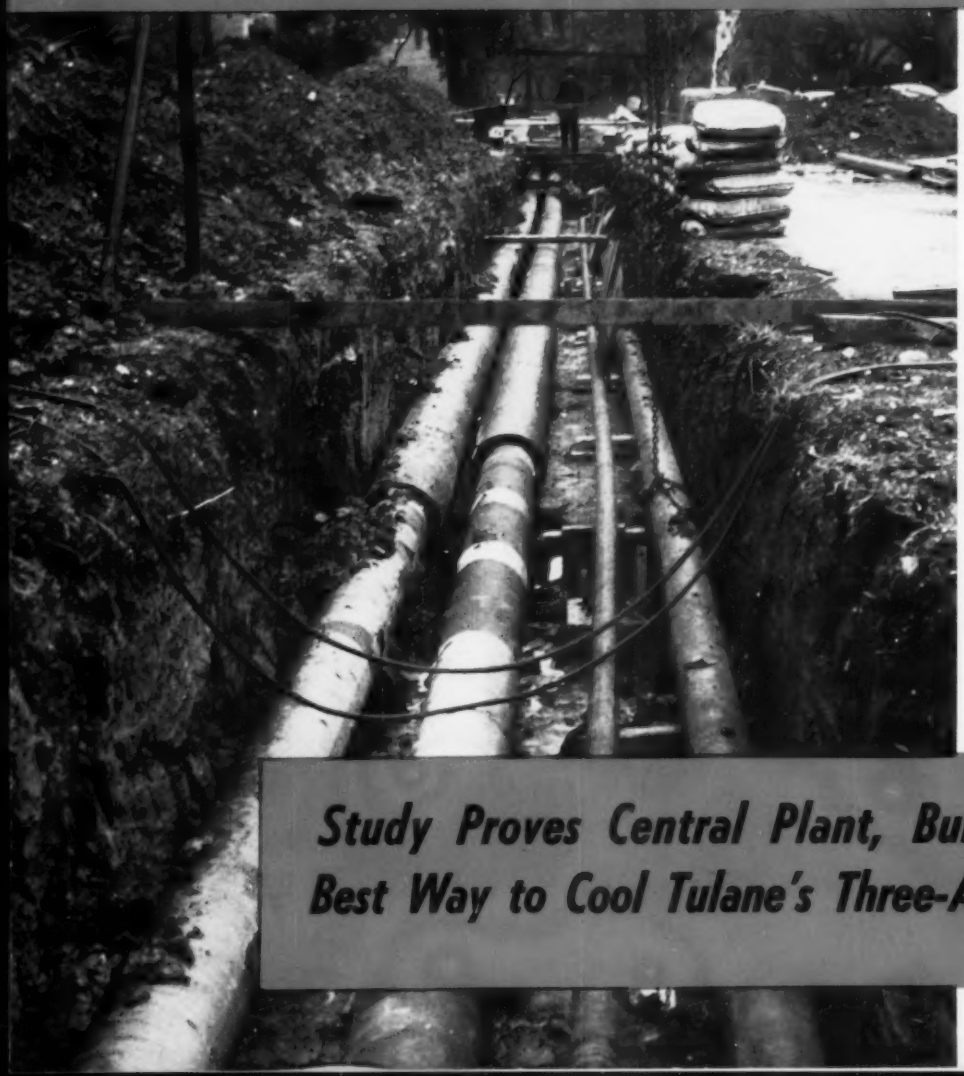

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Our Engineering Responsibilities

Worthington believes in, recognizes and understands two distinct types of engineering responsibilities.

The first type belongs to us. It is the type that is vital to the manufacture of products of excellence. This is the kind of engineering that makes it possible for Worthington to design, manufacture, and provide the air conditioning and refrigeration industry with the finest products possible. At Worthington, this type of engineering began 119 years ago with our founder, Henry Rossiter Worthington. It is still present at Worthington today with a modern and creative vigor.

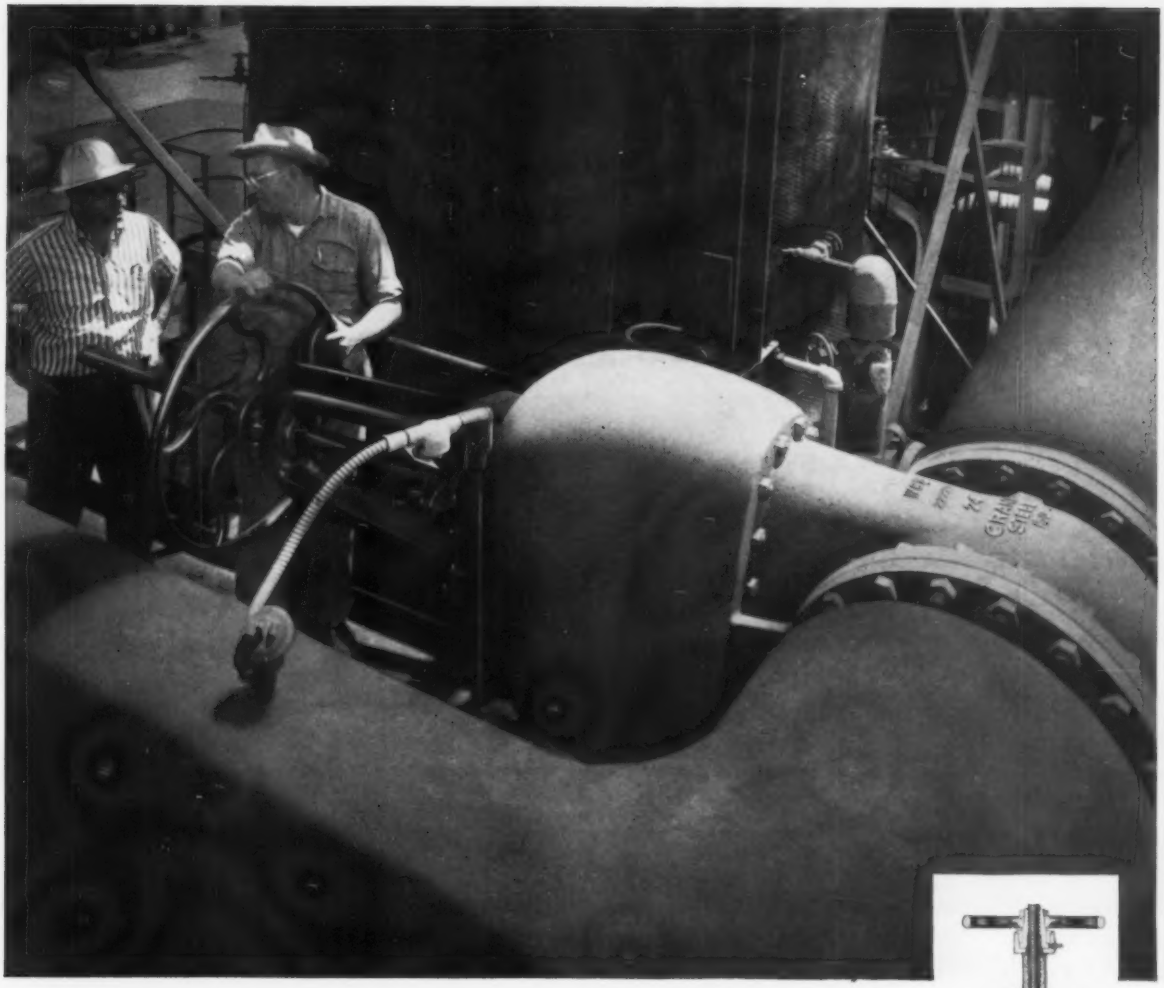
The second type belongs to you. This type involves the *use* of the product. It is the engineering of a system or application. It is the kind of engineering the customer wants and needs when he is buying more than just a product – when he's buying environment, comfort or health.

Engineering is specialized today. But the objectives have not changed. The best, most up-to-date products designed for the best, most up-to-date systems. And the biggest objective of all – to satisfy our mutual clients.

WORTHINGTON

Worthington Corporation, Air Conditioning and Refrigeration Division, Ampere Station, East Orange, New Jersey

17 years' service vindicates engineers' choice of valve



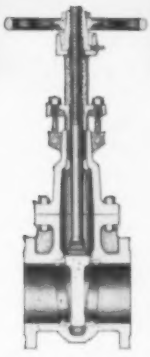
Crane 24″ gate handles 850° F. gases
17 years: no leaks...no maintenance

In 1942 Commercial Solvents Corporation, Sterlington, La., bought a hard-to-get Crane 24-inch, solid wedge disc steel gate valve.

At that time virtually all production was for national defense. Any down time for valve maintenance meant costly delays. So, this Crane valve was really on the spot—to justify its choice by plant engineers.

From the day the valve was installed to handle synthesis gas at 850° F. until today, the valve has not developed one leak. Nor has one cent been spent for maintenance. And the big 24-inch, hand-operated valve opens and closes as easily now as it did the day it went into service —17 years ago!

Measured in terms of production gains made possible by continuous, maintenance-free service, Crane quality-made valves more than pay for themselves. Ask your Crane Representative for quotations on any valves you need now.



The valve that's in its 18th year of service—Crane No. 47X, 150-pound, solid wedge disc steel gate. Available in 2 to 24 in. Other types for oil, oil vapor, steam, or water service for pressures up to 2500 pounds (and higher) and temperatures up to 1100° F. Your inquiry solicited. Write to address below.

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4-D WROUGHT IRON STEAM RETURN LINES

STEAM CONDENSATE CORROSION: the cause, the effect, and a suggested safeguard

4-D represents the most significant development in the history of wrought iron metallurgy. It was achieved by substantially increasing the deoxidation of the base metal, slightly increasing the phosphorous content and using a more siliceous iron silicate. Result is increased corrosion resistance, improved mechanical and physical properties.

Write for new 4-D Wrought Iron literature and our special report, The Use of Wrought Iron in Steam Condensate Lines. A. M. Byers Company, Clark Building, Pittsburgh 22, Pa.

WHAT CAUSES STEAM CONDENSATE—Steam, losing its heat, turns to moisture as temperature drops below saturation level. This condensate is distilled water, greedy for gases. Any gas in the steam is readily absorbed into this condensate as it cools. The condensate becomes violently corrosive to ordinary piping materials, depending upon the percentage of free CO_2 plus O_2 in the steam.

EFFECT OF STEAM CONDENSATE ON PIPE—Carbon dioxide is the primary cause of return line corrosion. Like oxygen, carbon dioxide is present in all raw waters and may enter the boiler with the feed water. Most of the carbon dioxide found in the steam cycle results from decomposition of the bicarbonate or carbonate content of the boiler feed water. Build-up of insoluble products of corrosion—particularly in smaller lines—may plug the pipe and render it useless. Corrosion may cause grooving, channeling, pitting, completely penetrating the pipe wall.

A PIPING MATERIAL THAT COMBATS IT—New 4-D Wrought Iron is a two-component metal consisting of high purity iron and iron silicate fibers. There are over 250,000 non-rusting glasslike fibers to every cross-sectional square inch. The purity of the iron itself, plus the protection of the iron silicate fibers are a mighty formidable deterrent to corrosion.

BYERS 4-D WROUGHT IRON

Heating Piping & Air Conditioning

Vol. 31, No. 4

(With which is merged the Aerologist)

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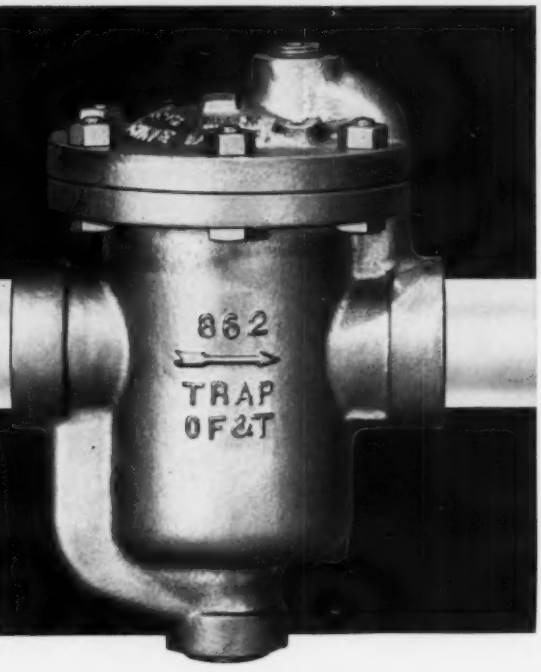

ARMSTRONG OPEN FLOAT AND THERMOSTATIC STEAM TRAPS

Engineered for low pressure intermittent service where large amounts of air accumulate while steam is off

Armstrong O.F.&T. Traps make it possible for heating systems to deliver the efficiency they were designed to deliver. They are ideal for low pressure unit heaters, pipe coils and standing radiation.

Advantages to the user:

BIG AIR HANDLING CAPACITY—Thermic vent handles large amounts of air in system when steam is turned on. Fixed vent handles normal air in system.

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MINIMUM MAINTENANCE—Simple, proved design and high quality materials assure trouble-free service.

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LOW COST—Mass production methods permit high quality at low cost.

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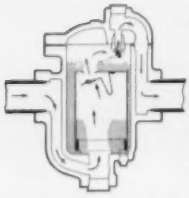
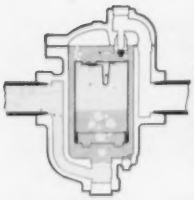
UNCONDITIONALLY GUARANTEED TO SATISFY THE USER.

HOW ARMSTRONG O. F. & T. TRAPS WORK:



When steam is turned on, it pushes air through the wide open thermic vent and trap discharge valve at full differential pressure between supply and return lines. Condensate formed by incoming steam goes right through.



As steam reaches open float, thermostatic vent closes. Float fills with steam and rises to close trap valve. Residual air and CO_2 escape through fixed vent at steam temperature.

BULLETIN NO. 775 BULLETIN NO. 801

Use the coupon at right to get these helpful bulletins: No. 775 describes O.F.&T. traps fully. No. 801 tells how to select traps for draining unit heaters including data on 30 makes of unit heaters.

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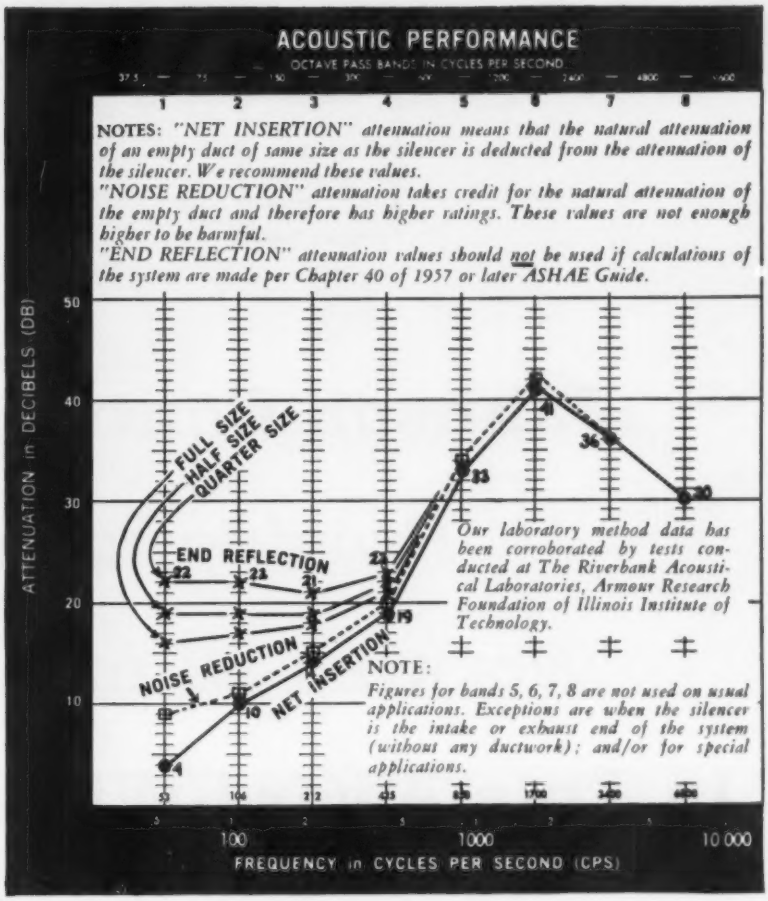
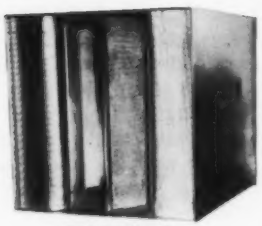
are the silencers you use ✳**rated** properly?


ACOUSTIC PERFORMANCE
OCTAVE PASS BANDS IN CYCLES PER SECOND
NOTES: "NET INSERTION" attenuation means that the natural attenuation of an empty duct of same size as the silencer is deducted from the attenuation of the silencer. We recommend these values.
"NOISE REDUCTION" attenuation takes credit for the natural attenuation of the empty duct and therefore has higher ratings. These values are not enough higher to be harmful.
"END REFLECTION" attenuation values should not be used if calculations of the system are made per Chapter 40 of 1957 or later ASHAE Guide.
ATTENUATION in DECIBELS (DB)
FULL SIZE
HALF SIZE
QUARTER SIZE
END REFLECTION
NOISE REDUCTION
NET INSERTION
Our laboratory method data has been corroborated by tests conducted at The Riverbank Acoustical Laboratories, Armour Research Foundation of Illinois Institute of Technology.
NOTE:
Figures for bands 5, 6, 7, 8 are not used on usual applications. Exceptions are when the silencer is the intake or exhaust end of the system (without any ductwork); and/or for special applications.
FREQUENCY in CYCLES PER SECOND (CPS)

THESE 3 PRODUCTION SIZES SAVE 20%



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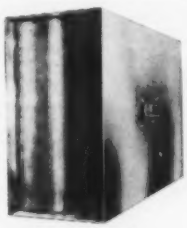

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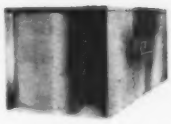

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MOD-U-SIZE silencers are easily "built-up" in parallel or in series to meet any requirement. Besides costing less, due to mass production and stock shipment, MOD-U-SIZE silencers achieve maximum economy by reducing handling and installation costs.

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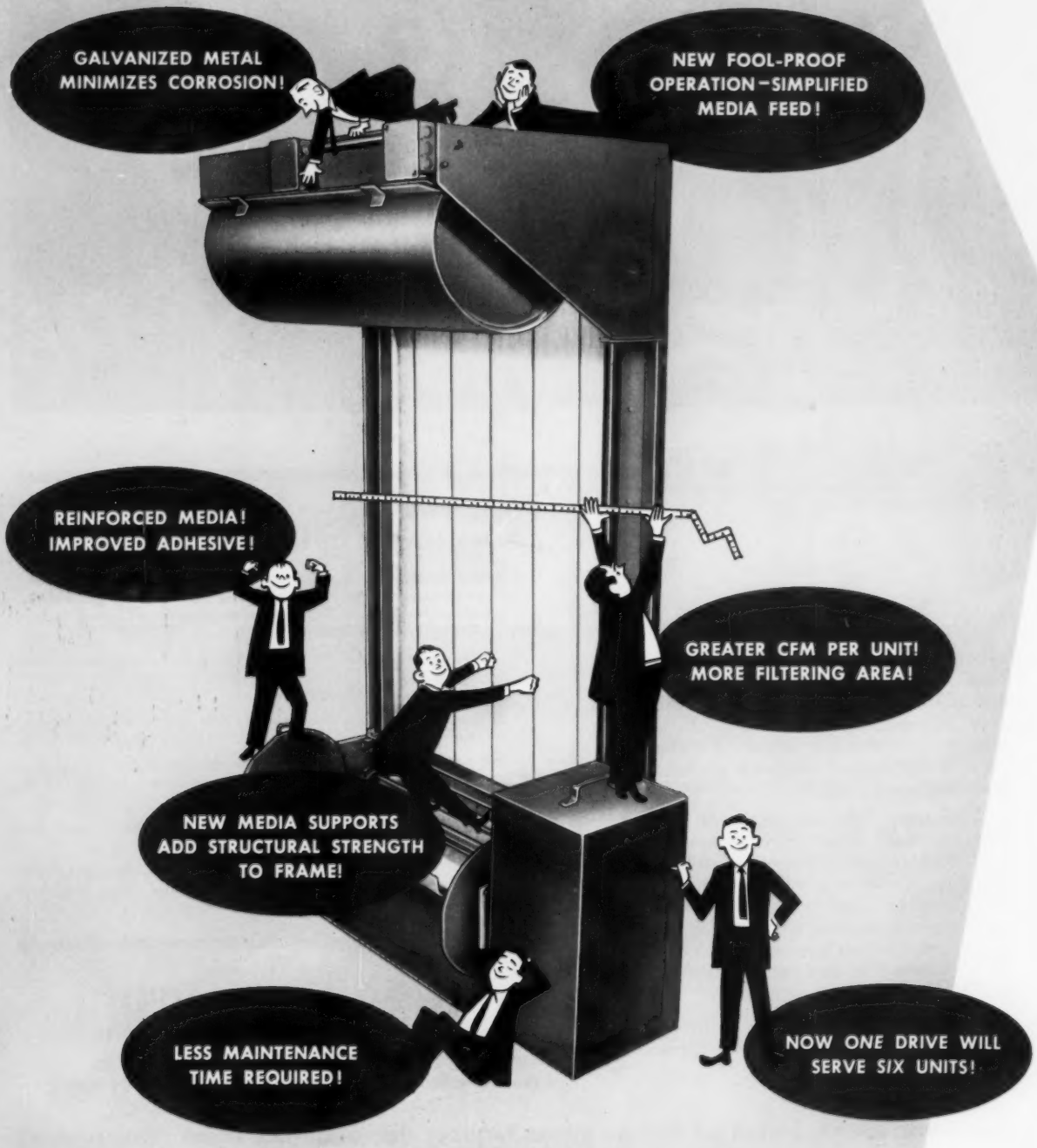
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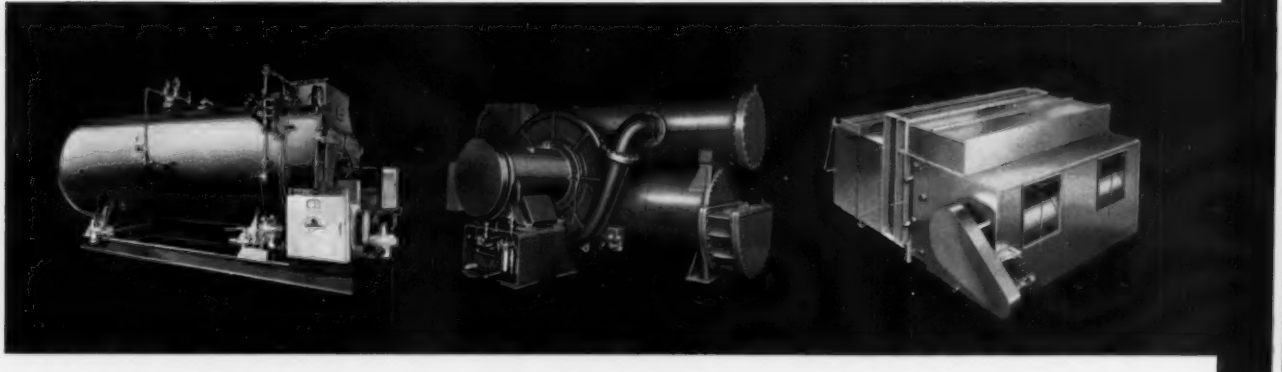

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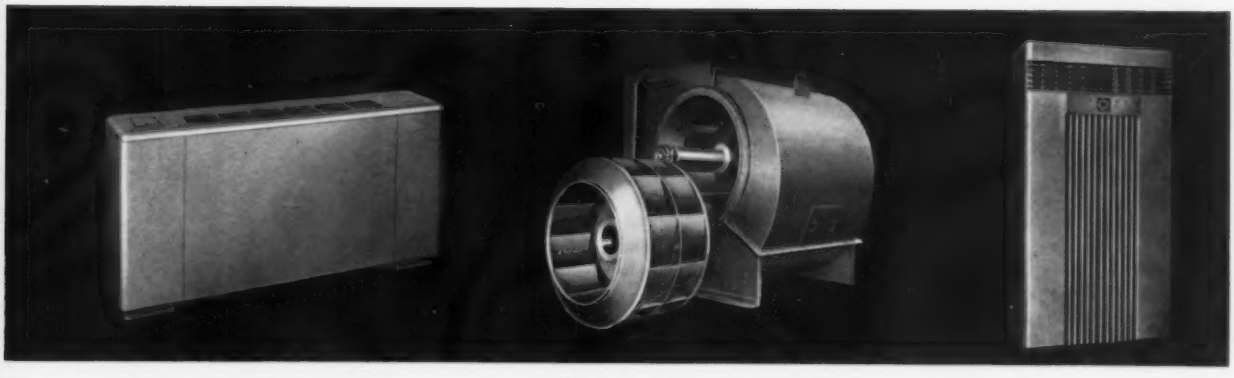

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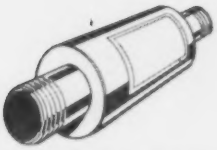

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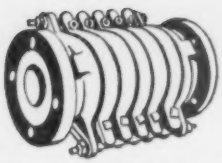

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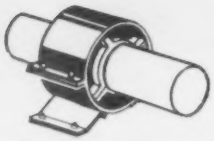

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EC-135

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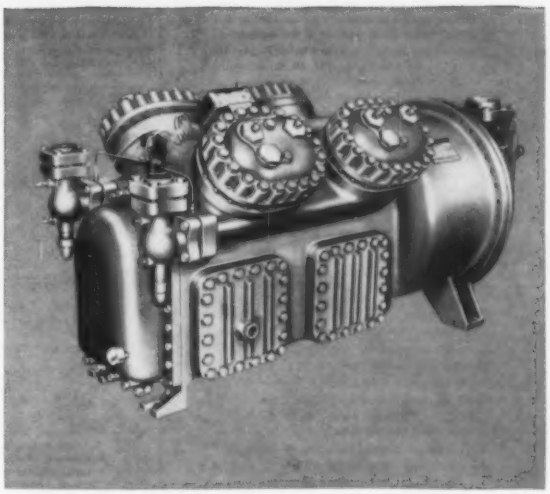

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WESTINGHOUSE TRANSISTOR PORTABLE RADIOS worth $39.95 each

-284 CHANCES TO WIN!

Hints to help you win

Your complete *air* conditioning and refrigeration wholesaler *is your* partner in profit. It will pay you to know and use his services, cultivate his friendship. Here are some of the benefits you get by dealing through your wholesaler.

- **Convenience** of buying at a one-stop supply source. Your wholesaler keeps ample, diversified stocks of high-quality air conditioning and refrigeration parts, equipment and supplies.
- **Immediate delivery** by your wholesaler permits you to give prompt, dependable service—imperative in emergencies.
- **Cost savings** because your wholesaler assumes expenses of inventory, warehousing, shipping, accounting and insurance.
- **Expert technical and engineering help** when you want it. Your wholesaler assists with design problems, figuring material costs; gives catalog service, prices and up-to-date information on new products.

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Look for this list of premium qualities of "Freon" refrigerants on your official entry blank. Check the one you consider most important.

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- ☐ Stable, pure and dry.
- ☐ Factory-sealed for purity.
- ☐ Nontoxic, nonflammable.
- ☐ Always available—anywhere in the world.
- ☐ Made by Du Pont—backed by years of technical and manufacturing leadership.

Insist on genuine "FREON"—Premium Quality Refrigerants . . . in the cylinders with the gold-band caps.

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CONTRACTORS, SERVICE MEN . . . You could be the winner of a new air-conditioned Chevrolet station wagon. But to win, you must enter the Freon® "Partners in Profit" contest . . . and enter SOON. Read over the simple rules and hints to help you win. It's easy! You can enter as often as you wish—but HURRY . . . *closing date is May 15.* If you haven't yet sent in *your* entry, see your *complete air conditioning and refrigeration wholesaler* TODAY.

SIMPLE CONTEST RULES:

1. Contest is open to all firms and their employees who are customers of complete air conditioning and refrigeration wholesalers, providing that the customer firm purchases "Freon" refrigerants from a complete air conditioning and refrigeration wholesaler during the contest period (January 26, 1959 to May 15, 1959). Employees of E. I. du Pont de Nemours & Co., its subsidiaries, its agencies or its wholesale distributors of "Freon" refrigerants are not eligible to enter the contest.

2. Check the quality of "Freon" most important to you.

3. Complete this statement in 35 *additional* words or less: "I believe it is good business to deal through a complete air conditioning and refrigeration wholesaler because . . ."

Mail your entry to: **FREON® CONTEST, Box 227 Mount Vernon 10, New York**

Entries must be postmarked by May 15, 1959, and received by us at least within eight days of this date.

4. You may enter as often as you like. Your entry must be your own original work and must be submitted in your own name, on an official entry blank, obtainable through your complete air conditioning and refrigeration wholesaler.

5. Prizes awarded by Reuben H. Donnelley Corp., on the basis of their judgment regarding originality, sincerity and aptness of thought. Duplicate prizes awarded in case of tie.

6. Judges' decisions are final. All entries and ideas become the property of E. I. du Pont de Nemours & Co. (Inc.). None will be returned. Contest is subject to federal, state, and local regulations.

7. Winners will be notified about six weeks after close of contest.

LETTER FROM THE EDITOR

April 1959

Dear Reader:

How and why a central air conditioning plant was chosen for Tulane university is discussed in the article beginning on page 101 by Irwin Isaacson and William R. Pitcairn. Three alternate methods were studied, and it was shown that the first cost of providing a central plant to take care of 12 existing buildings was more than the total cost of providing an individual plant for each building. As the number of buildings to be air conditioned was increased, the sum of the costs of the individual plants approached and then exceeded the cost of the central plant and distribution system. However, the operating and maintenance cost was much lower with the central system than with the individual plants. Packaged boilers deliver steam to drive two 800 hp turbine driven refrigeration compressors to serve the load in the buildings now under construction. As the program for air conditioning the existing buildings and for adding new buildings on the campus progresses, two additional 1500 ton compressors are to be installed to provide an ultimate capacity of 4600 tons.

How the problem of heating high level industrial plants satisfactorily was solved is explained by John Vonderheide in his article beginning on page 106. Not only the height of the building but complex production equipment often prevents the delivery of warm air during the winter down in the occupied zone for the comfort of the workers. He explains how unit heaters were relocated in one large plant at a maximum height of 20 ft and near the walls so as not to interfere with any equipment. Also, small outdoor air make-up units were replaced with large systems which were mounted in roof penthouses. Ducts from these units were installed so as to deliver the tempered air to the occupied area and thus eliminate discomfort of the workers.

Frost on air cooling coils can cause a lot of trouble. Lester T. Avery cites several points that should be considered if this becomes a problem in his "Tricks and Trends" feature this month on page 109. Some of these are dirty filters, loose fan drives, slight leakage of refrigerant, and improper operation of the controls.

The schedule number system for identifying pipe wall thicknesses is 20 years old this month. The standard, ASA B36.10, Wrought Iron and Steel Pipe, which removed the confusion and provided a "meeting of the minds" among designer, installer, user and supplier regarding pipe wall thicknesses, was adopted on April 28, 1939. Some of the historical highlights that led to the establishment of the standard are discussed by H. H. George in his article which begins on page 110. Also included are data on current pipe sizes and wall thicknesses as they are defined by the standard.

Air conditioning of hospitals is becoming more of a necessity all the time. Robert W. Flanagan explains how the Iowa Lutheran hospital in Des Moines was completely air conditioned in his article beginning on page 114. A ceiling mounted high velocity induction system was chosen after much consideration. The problem of air conditioning this hospital was complicated because the first part was built in 1913 and additions were made in 1951 and 1957. The high velocity duct system provides ventilation during the winter.

Industrial plants that require 100 percent outside air for ventilation must have these systems designed for reliability and protection against freezing. John H. Clarke explains how to design these systems for freeze protection in his article on page 125. He says that steam must be supplied from a reliable, clean source at constant pressure. Piping should be designed with control valves at high points to permit draining condensate in either direction during shutdowns. He also mentions strainers, traps, and vacuum breakers as being very important and explains what should be considered in their selection, installation, and operation.

Refrigerant piping applications for field erected direct expansion air conditioning systems, discussed by J. R. Chamberlain at the recent ASHAE meeting in Philadelphia, are reviewed on page 120. HPAC's staff has summarized his remarks on how these piping systems should be designed and installed. This report includes such phases of the subject as sizing the suction and discharge lines, preventing the accumulation of oil in the suction line and preventing refrigerant from entering the crankcase of the compressor, how to prevent leaks, and what controls should be used. How to choose the right pump for a closed hydronic system, discussed by G. F. Carlson at the same meeting, is reported on page 136. He stressed the need for analysis of the overall system characteristics in attempting to select the most economically desirable standard pump. Also included in this report is a design procedure which considers all these factors.

Air pollution control was one of the subjects discussed at the recent plant maintenance and engineering conference, and a report by O. C. Thompson is on page 131. He urged each plant engineer attending the meeting to organize and enforce an industrial wastes abatement program as a local "good neighbor" policy. He recommended nine steps for the organization and operation of a plant air pollution control program and these are given in this report.

The "HPAC Engineering Data File" this month, on pages 141 to 162, is on the subject of what to consider when selecting globe and gate valves. It has been prepared by Carl Dopp, as was the Data File report on valves in the January issue. He is a member of our board of consulting and contributing editors and has had many years of valve experience. This month he explains how globe and gate valves are made in a number of designs to satisfy the requirements of the many different services encountered in power and process systems. Selection of the proper seating design, operating means, and bonnet connection is essential for satisfactory operation. Failing to consider these components in design and selection may result in expensive valve maintenance or replacement. Information on the selection of gate and globe valves and their important components for successful application is presented in this report.

Question of the Month is on pages 96 and 98 and is on the subject of locating an induced draft fan. Two replies to this question are published this month and these explain that the size and type of boiler determine the best induced draft fan location. Also, it is suggested that uniform air distribution to and from the fan should be provided in order to minimize noise and vibration and loss of capacity. The HPAC Data Sheet this month is on pages 123 and 124 and it contains a new nomograph which converts total or velocity head of a fluid into its equivalent pressure by eliminating tedious calculations. Don't miss the "Open for Discussion" on pages 91 through 94. You'll Want to Know this month is on pages 29 to 34.

Bob Roose

Editor, HEATING, PIPING & AIR CONDITIONING

HOW TO GET PERFECT BALANCE ON CHILLED WATER LINES and throttle or shut-off with one valve

Rockwell-Nordstrom fig. 143, 150 lb. valves on chilled water circulation system at 300,000 sq. ft. fully air conditioned manufacturing plant in Texas.

More and more air conditioning designers are relying on Rockwell-Nordstrom lubricated plug valves for perfect, one-valve control of chilled water systems. On any size line, these *lubricated* valves will give you design and operating advantages that you can't expect from ordinary valves. A few of these advantages are shown below. For details, write for literature; or better yet, talk to a Rockwell field engineer.

1. *Perfect Balance:* Plug is smoothly, quickly positioned . . . wrench shows degree of throttle.
2. *Throttle Shut-Off:* Pressurized *lubricant* sealing that can't "wear out," plus unexposed seating, assure positive shut-off. Seats never exposed to line, eliminating main cause of throttle valve failure.
3. *No Chance Of Chatter:* The solid, *tapered* plug is seated perfectly in valve body . . . no chatter even after years of throttling service.
4. *Compact:* No bonnet cavities or rising stem member . . . saves weight, space.
5. *Sizes To 36":* Chill water lines above 8" are no longer a problem, you get size and pressure rating you need to meet *your* design requirements.

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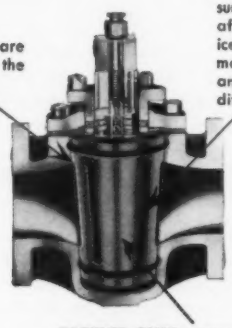

TAPERED PLUG assures positive seating and permits constant contact between the plug and body. Vibration is eliminated during opening, closing and throttling.

Rockwell-Nordstrom is the *original* and world's most complete line of lubricated plug valves, plug valve accessories, and lubricants. Available through leading suppliers everywhere. Rockwell Manufacturing Company, Pittsburgh 8, Pa. Canadian Valve Licensee: Peacock Brothers Limited.

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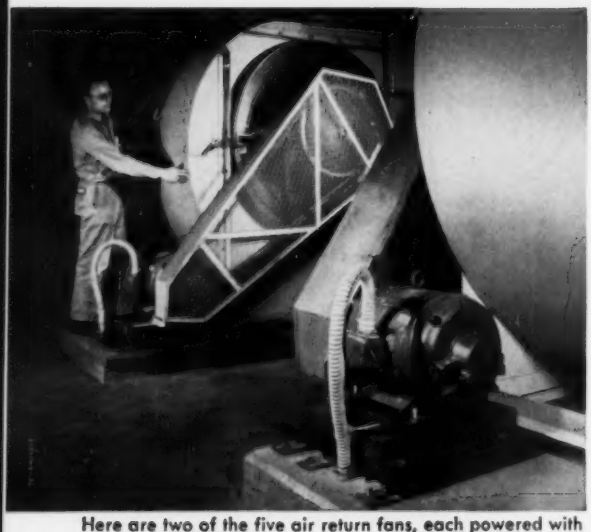
HAVE YOU BEEN THROUGH ST. LOUIS' AIRPORT?



Here are two of the five air return fans, each powered with 15 hp Wagner Motors.

Chances are, you have . . . some 133,000 air travelers pass through this handsome Municipal Airport each month. And, chances are, you've been impressed with the clean, soaring architectural lines of the building and with the clean, fresh, always comfortable atmosphere.

The job of efficient air movement for this 50,000 square foot building is handled by five air supply fans and five air return fans—all driven by Wagner electric motors . . . five 40 hp motors for air supply and five 15 hp motors for the air return fans. Their quiet, efficient operation in this application is typical of the service record of Wagner motors in millions of applications all over the nation.

Whatever your motor requirements may be, Wagner can supply a standard motor or build a special motor to fit your need. Constant research and development have kept Wagner up front in electric motor design for more than 65 years—made the name Wagner one you can trust in choosing motors for your plant or for your product. Call your nearby Wagner field engineer for an engineering analysis of your next motor application. There are Wagner branches in 32 principal cities.

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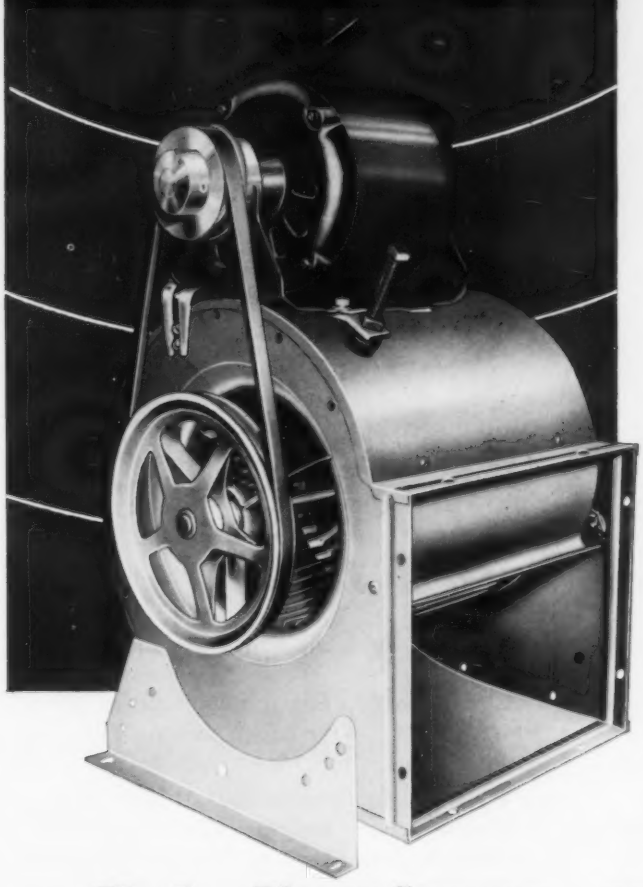
SERIES A



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Standard Series A features include such Lau exclusives as Preslok® wheels, ground and burnished shafting, Lau Pak Gold Seal bearings, tripod bearing brackets, heavy gauge housing supports, versatile motor mounts, and Lausteel pulleys.

Series A blower assemblies are recommended for warm air furnaces, central air conditioning systems, evaporative coolers, cooling towers, and remote condensers.

Write or call Lau today. We will place you in contact with your experienced Lau Sales Engineer. He's always nearby and ready to help you solve any air moving problem.

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The Lau Blower Company, 2027 Home Avenue, Dayton 7, Ohio.

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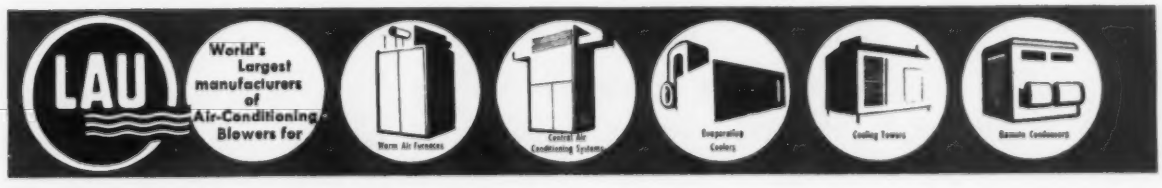

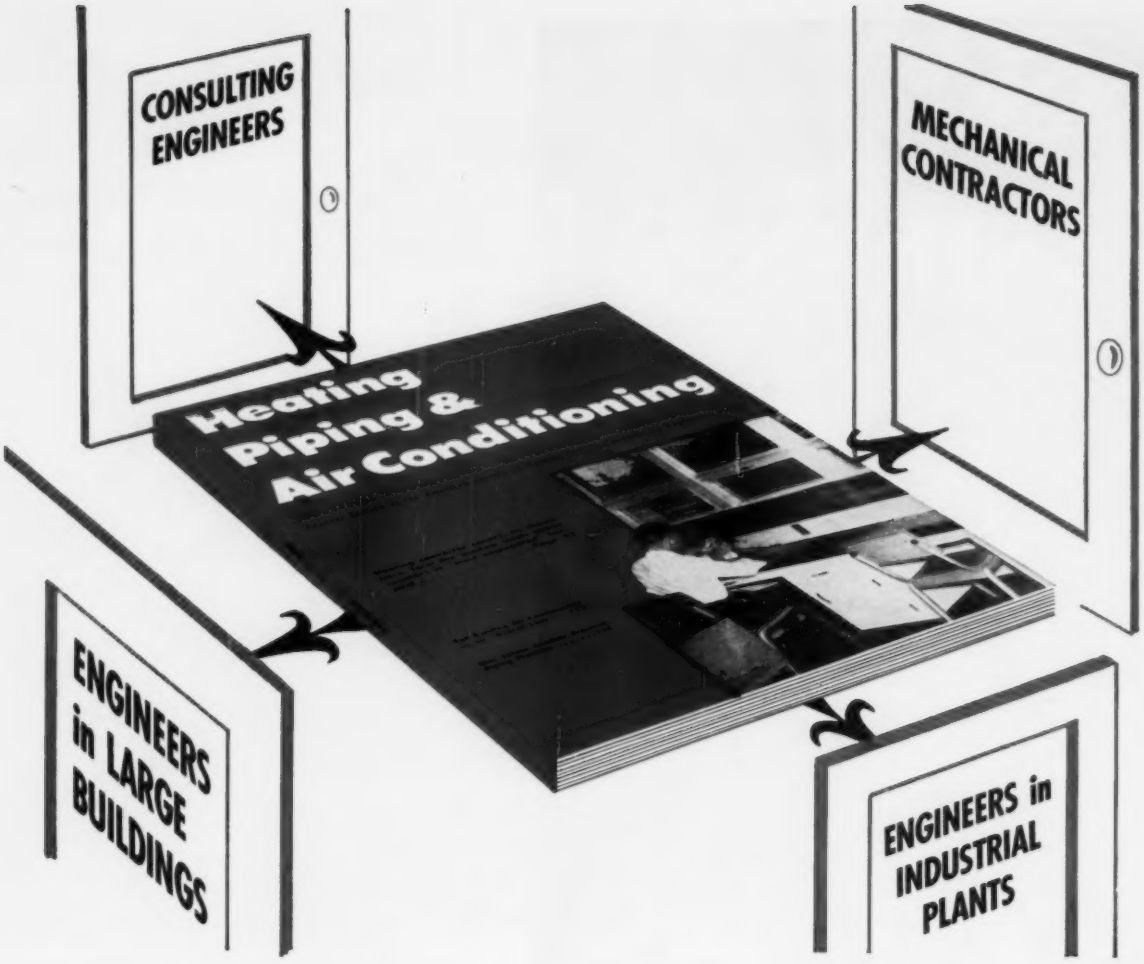

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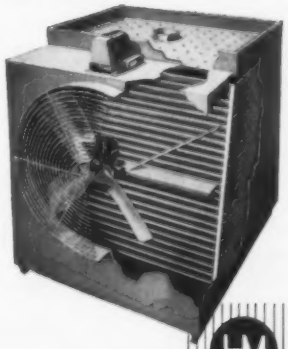

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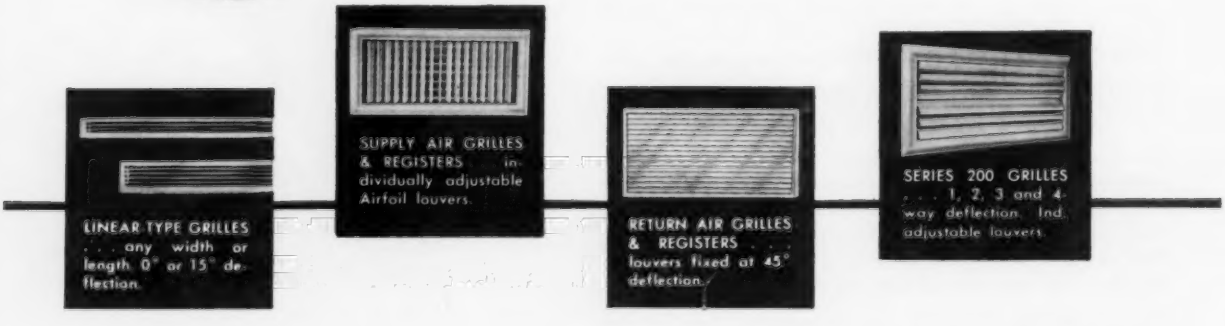
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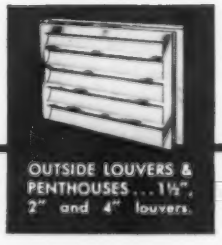

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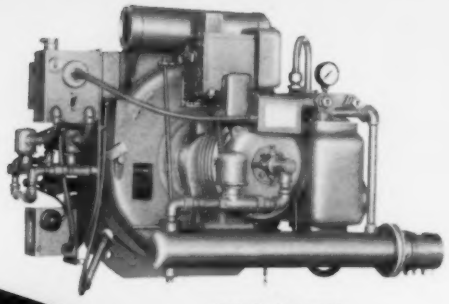

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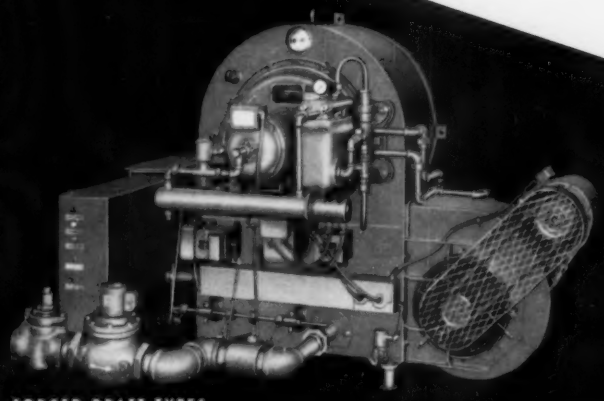
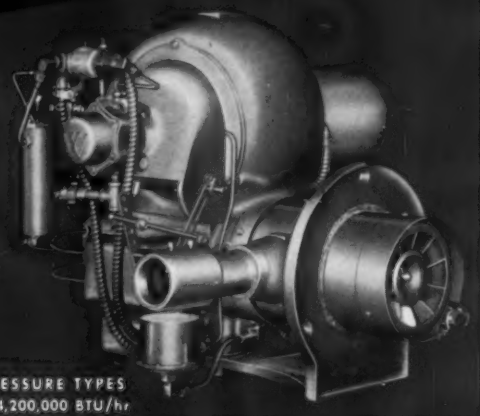


FORCED DRAFT TYPES
600,000 to 31,500,000 BTU/hr



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Heating Piping & Air Conditioning

April 1959

You'll Want To Know...

New Air Pollution Law Explained to Ventilation Men

For news of new products, see the Equipment Developments department in this issue, and for new catalogs, bulletins, etc., see the Recent Trade Literature columns. Other news material also appears in the Who's What and the We Hear That departments. Meetings and Conventions are listed toward the back of this issue under that title, as are New Books and Reports.

CHICAGO'S NEW AIR POLLUTION control ordinance, which becomes effective May 1, is not as specific in its requirements as are other of the city's laws — such as the new ventilation code, for example. This is due to lack of information and data on the effects of air pollutants and methods of controlling their emission from various processes and sources. However, Chicago ventilating contractors and consulting engineers were told last month by Thomas Carey, director of air pollution control, that his department would work with them to apply the regulations fairly and reasonably as specific problems come up.

The occasion was a dinner meeting of the Ventilating & Air Conditioning Contractors Association of Chicago, held at the Bismarck hotel, to which a number of consulting engineers active in heating, piping, and air conditioning work had been invited. Philip Olmen, president of the association, presided, and Henry J. Couch, executive secretary, reviewed highlights of the new ordinance. Fred T. Mommsen, assistant director of the department of air pollution control, explained the background and some of the provisions of the code.

Of particular interest to ventilating contractors are the code requirements relating to pollutant emissions from industrial processes, said Mr. Couch. He made special note of the section allowing the director of air pollution to require proof of financial responsibility and of ability to make any changes that may be required after installation of any system for which insufficient data to estimate the air pollution potential has been provided, because a design or process is unconventional or untried, or because confidential details have been omitted. If adequate proof is not given, the director may require filing of a surety bond, not to exceed $50,000, in favor of the city.

Although we can never be expected to be surrounded by 100 percent pure air, air pollution is everybody's business — not just the department's — said Mr. Mommsen in the course of his remarks. Too much air pollution is caused by "just plain carelessness," he stated.

Questions from the floor indicated concern about when plans and speci-

fications for exhaust systems should be submitted to the department of air pollution for approval, when an exhaust becomes a pollutant, etc. It was indicated that plans for exhaust systems will be submitted to the department of air pollution through the department of buildings. The air pollution department, with the aid of a technical advisory board, expects to establish rules and regulations on the submission of plans.

According to the ordinance, all plans and specifications submitted for approval require the seal of a registered professional engineer.

John Aeberly, chief of the city's bureau of heating, ventilating and industrial sanitation, and a special guest at the meeting, advised the contractors "not to anticipate too much trouble" in complying with the new ordinance, and said that no doubt the department of air pollution "would tie-in in some way" with the city department of buildings regarding what plans and specifications required approval.

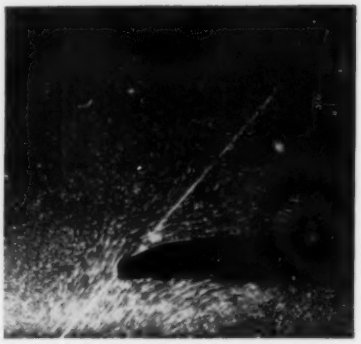
Future Building Continues to Gain

CONTRACTS FOR FUTURE construction in the United States (except Alaska) in January totalled $2,319,167,000, up 12 percent compared to January 1958, according to a statement recently issued by F. W. Dodge Corp.

January non-residential contracts amounted to $818,225,000, a gain of 8 percent over the same 1958 month. Substantial gains were reported in contracts for commercial, hospital, religious, and other large buildings.

You'll Want To Know

Water Tunnel Helps Study of Fan Design Characteristics



A UNIQUE "water tunnel," which permits three-dimensional studies of fluid motion around complex structures, is helping to determine design characteristics for ventilating fans and other rotating equipment, according to Westinghouse Electric Corp.

Essentially, the water tunnel serves the same purpose as a wind tunnel, although it is smaller and uses a liquid rather than air. The tunnel allows engineers to study and photograph fluid flow around a structural model or machine component. Flow patterns around a simple structure, such as a sphere, can be calculated comparatively easily. However, mathematical analysis is too cumbersome for intricate structures, so the water tunnel was developed to provide needed development information.

The water tunnel is actually a vertical pipe, about 2 ft in diam and 20 ft high. One section of the pipe is made of clear plastic, inside which the model being studied is mounted. A 7½ hp electric motor rotates the model. The propeller pump used to force water through the pipe is driven by a 30 hp electric motor. Flowing through the pipe are 13 tons of water, moving at a rate of 8000 gpm.

A stroboscopic flash unit is used to photograph the flow. Tiny air bubbles, oil droplets, or small particles of plastic are injected into the water stream to make the flow pattern visible. The temperature of the entire 13 tons of water in the tunnel is adjustable from room temperature up to 150 F.

Weather Bureau Reports Discomfort Index

THE U.S. WEATHER BUREAU announced last month that many of its stations will make use of a new discomfort index next summer.

Calculation and announcement of the discomfort index, derived from heat and humidity measurements, will be on an experimental basis until it is determined whether there is enough public demand to make the service permanent. The discomfort index was developed by Earl C. Thom, a climatologist in the bureau. After considerable study, he arrived at a curve showing what percentage of the population will be uncomfortable and in what degree for various values of the index. Values for the index are determined from temperature and relative humidity measurements. For example, an air temperature of 75 F with a relative humidity of 100 percent gives a discomfort index of 75. The same index results when a temperature of 80 F occurs with a relative humidity of 60 percent, and when 85 F occurs with 33 percent and when 90 F occurs with 13 percent.

Obviously, there are limitations to this index, and it should be used only as a guide. The index can perhaps be helpful to plant and building engineers in suggesting when air conditioning equipment should be started, and to utilities to indicate when the air conditioning load may be increasing.

Pipe Bending Supplement Now Available from UA

A NEW "Pipe Bending Supplement Number 5" can now be obtained from the United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry,

United Association Bldg., 901 Massachusetts Ave., N. W., Washington 1, D. C.

The information in this publication has been prepared and approved by the National Joint Pipefitter Apprenticeship Committee, composed of representatives of the Mechanical Contractors Association of America and the United Association.

Among the subjects covered in the pamphlet are: bending equipment, mathematics of bending, bending problems, bending dimensions, bending methods, fillers and mandrels, and portable benders.

See Nuclear Energy As Air Conditioning Power Source

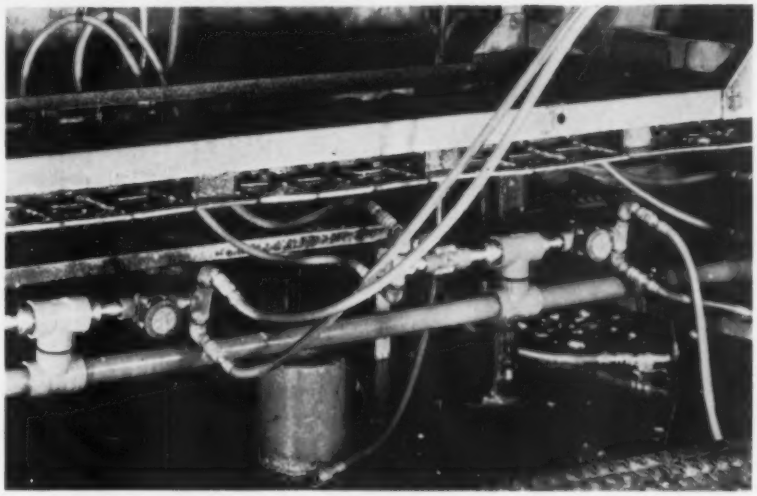
NUCLEAR FISSION will run air conditioning and refrigeration equipment in the near future, according to Dr. J. F. Downie Smith, vice president in charge of the Research and Development Division of Carrier Corp. "Reactors could be used in this country now but other energy sources are less expensive, he said.

"But within 10 years nuclear fission will be employed extensively to create both heat and electricity. In some parts of the world nuclear power is already competitive with conventional generating plants. The use of such heat or electricity to 'drive' air conditioning and refrigeration equipment should be an immediate, practical application," he stated.

Don't look for a nuclear reactor in every air conditioned home or office building, though. Dr. J. F. Downie Smith says they will be owned in nearly every case by utility companies which will continue to furnish the electricity or steam required by the customer.

As for cost, new designs, more experience and heavier volume are fast bringing the price of this 20th century marvel down to the point where it will be able to provide energy at prices comparable to the fossil fuels—coal, oil, and gas—used today to provide the "juice" that runs air conditioning units and systems.

UPVC Piping Handles Pickle Brine in Meat Packing Plant



UNPLASTICIZED polyvinyl chloride (UPVC) pipe and fittings have been installed to handle sweet pickle brine solution used to cure hams and bacon at the packing plant of Patrick Cudahy, Inc., Cudahy, Wis., according to Tube Turns Plastics, Inc.

This pipe, with fittings and valves, has been in service now for over two years with no sign of deterioration, the company said. The installation includes high-impact UPVC in ½ to 3 in. pipe sizes. The piping has withstood corrosion both inside and out. The sweet pickle brine solution contains a measure of tri-polyphosphate, and is circulated at temperatures of 35 to 40 F and pressures up to 90 psi. The pipe and fittings are exposed to exterior corrosion where they are installed directly in brine tanks, under ham pumping conveyor lines, and in areas where the combination of brine and humidity create a corrosive atmosphere.

Hydronic Heating Sales Show Continued Sharp Rise

THE HYDRONIC HEATING industry scored substantial sales gains in 1958 over the preceding year following an upsurge in shipments which started in the summer months and continued unabated during the fourth quarter, the national Better Heating-Cooling Council reported recently.

Sales gains were seen in shipments reported for the year by the Institute of Boiler and Radiator Manufacturers, the Gas Boiler Division of the Gas Appliance Manufacturers Association and other informed industry sources.

Cast iron boilers were reported up 5 percent, baseboard radiation up 10 percent and gas-fired boilers up 14.7 percent. Shipments of steel boilers and commercial finned-tube radiation were reported close or equal to 1957 shipments.

Year-end totals included estimates of final fourth-quarter figures. Incomplete fourth-quarter returns for 1958 indicated major increases over the previous year's last quarter.

You'll Want To Know

Infra-Red Heaters Used for Limited Area Application

SEVEN GAS-FIRED, infra-red heat generators heat the half of the Junkin Safety Appliance Co.'s building where its employees work, leaving most of the storage area unheated. These units are suspended overhead, and they provide direct heat, by radiation to the floor, tools, materials and personnel below them, according to Perfection Industries, Div. of Hupp Corp.

The seven units are suspended in one line along one side of the 50 × 100 ft building and provide high temperature radiation over a 25 × 85 ft area. The radiating surface temperature is 1600 F, and the combined heat output of all seven units is 168,000 Btu per hr.

Each heater has a ceramic burner element which is the radiating surface. Air drawn from the atmosphere is mixed with gas in a chamber behind the ceramic surface and is passed through hundreds (200 per sq in.) of small holes in the ceramic face where it burns as a separate flame at each hole. Combustion is completed within $\frac{1}{8}$ in. of the ceramic face. The rear face of the ceramic element never exceeds 400 F.

More than half of the fuel's energy is converted to infra-red rays of lengths mostly 1.5 to 6 microns. The remainder of the heat output is diffused through the space by natural convection.

All seven heaters are controlled by one thermostat, located 4 ft above the floor on the heated side of the building.

You'll Want To Know

Chicago Architects Favor Separate Bids

A RECENT SURVEY of architectural offices in the Chicago area has shown that 71 percent are in favor of separate bids on heating, ventilating, plumbing, and electrical contracts.

This information was obtained from a questionnaire sent out by the Coordinating Committee of the Mechanical Specialty Contractors Association of Chicago, which is composed of representatives of the Chicago Ventilating & Air Conditioning Contractors Association, Mechanical Contractors Association, the Electrical Contractors Association of the City of Chicago, and the Plumbing Contractors Association of Chicago. These four associations represent a total of 413 individual contracting firms. The coordinating committee is actively promoting separate bids.

General Sees Construction as Key in Atomic War

THE SIDE WHICH can most quickly dig its way out of the debris of the initial attack and marshal what is left of its economic and military strength is going to have the best chance of winning the next war, according to Maj. Gen. E. C. Itschner, Chief of Engineers, U. S. Army.

In recovering from the initial attack, General Itschner said, "construction men, equipment and know-how will bear an importance to this effort second only to the armed forces."

Speaking before The Associated General Contractors of America recently, General Itschner said if a city were hit by a 10-megaton nuclear surface burst, it would take 75,000 men nearly a month just to decontaminate the area to permit rescue and rehabilitation work to proceed.

To clear the streets, he estimated it would require 1200 power shovels, 1200 drag lines, 2000 bulldozers, 1000 trailers and 7000 trucks. Five billion gallons of water would be needed, he said, in an area where power and water facilities would have been destroyed.

"Multiply this by some 20 or more metropolitan areas that might be hit and require rehabilitation," he said, "and you come up with a construction job that staggers the imagination."

General Itschner predicted that the construction industry will expand at an even higher rate than most people believe because construction capability is concerned in three ways with the problems of national survival.

The construction industry, he said, must have the capacity to build quick-

ly and efficiently the complex bases for deployment of the intercontinental missile and interception of missile attacks upon us; it must be able to rebuild for the comeback faster than the enemy; and finally it must be able to build facilities to support the phenomenal expansion "required by our explosive population growth."

"Any way you measure it," he said, "the national construction task, both civil and military, is growing larger, more difficult, and more vitally important. The trend will continue into the foreseeable future."

Diffuser-Fixtures Cool Computers

AN UNUSUAL HEAT PROBLEM created by a large installation of electronic computing machines at the home offices of the Travelers Insurance Co., Hartford, Conn., was solved recently through the application of a combination ceiling light fixture and air diffuser.

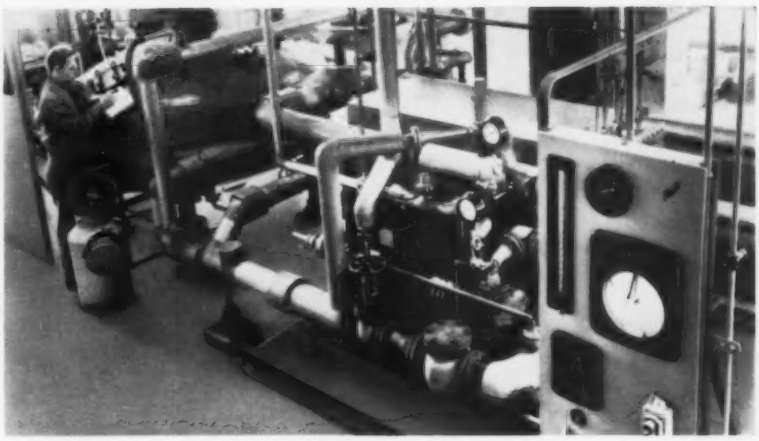
Planning to install a data processing system in the company's statistical department last August, engineers sought a draft free air cooling method to offset the heat from more than 20,000 electronic tubes contained in the units, and still retain the appearance of the drop ceilings.

A flush-mounted fluorescent lighting fixture hiding a low velocity air diffuser was used to handle the cooling problem, according to the Multi-Vent Div. of the Pyle-National Co.

New Officers for Northern Calif. RACCA

AT THE SECOND ANNUAL CONVENTION of the Refrigeration and Air Conditioning Contractors Association of Northern California, the following new officers for the coming year were elected: Kenneth Zappettini of Donnelly and Zappettini, San Francisco, as president for 1959; Dolph Lerza, Lerza Refrigeration, Redwood City, vice-president; Kenneth Morris, Power Refrigeration, San Francisco, secretary; and Walter W. Baldwin, Refrigeration Engineering Co., Sacramento, treasurer.

Electric Resistance Heating Used in Process Application



TO HEAT AND COOL a jacketed kettle for unusual reaction conditions a packaged system using electric resistance heating units has been installed in the chemical plant of Hoffmann-La Roche, Inc., Nutley, N. J.

The 100 kw unit raises kettle temperatures up to 550 F under close control. Cooling is provided by a heat exchanger that is also incorporated in the system, according to the Hynes Electric Heating Div., Turbine Equipment Co. The unit operates at a maximum of 50 psi.

A 3 hp power motor driven pump provides a high oil velocity through the heater passages. The complete unit occupies a space of 7 ft × 5 ft, 10 in. × 5 ft, 5 in. The heater operates on 3 phase, 60 cycle, 440 volt current. The elements are wired in increments of 25 kw each for close temperature control and for economical use of electricity. The heater, motor, and controllers are all explosion-resistant.

Court To Be Oldest Air Conditioned Building in World

THE 117 YEAR-OLD Court of Appeals hall in Albany will be the oldest building in New York State—and the world—to be air conditioned when its reconstruction is completed at the end of 1959, according to Carrier Corp.

Under a $3 million modernization program, the interior of this three-story building for the State's highest court has been stripped. A new motif designed by Gehron & Seltzer, New York City architectural firm, under direction of Carl W. Larson, State Architect, is now under construction. Air conditioning, better lighting, and modern interior decoration are included in the program. The air control system is designed to assure that new efficiencies provided by refurbishing will be effective.

Quiet operation of comfort apparatus was one of the chief objectives given Rutherford L. Stinard, New York City consulting engineer, in designing the system. A hermetic centrifugal refrigerating machine with a capacity of 118 tons will provide the cooling.

You'll Want To Know

Well Water To Cool New Bank Condensing Units

UNDER CONSTRUCTION now and to be completed next year is the new First National Bank Building in Minneapolis. The heating and air conditioning systems for this new 28-story building are being installed by the B/C Co., a joint venture of Bjorkman Brothers Co. and Commercial Air Conditioning, Inc., both of Minneapolis.

The entire area of the sixth and 27th floors along with the sub-basement are devoted to the heating, air conditioning, and other mechanical equipment. Two centrifugal compressors provide the necessary 1800 tons of refrigeration capacity and three deep wells will deliver a total of 3000 gpm to supply the condensers for these compressors.

There are 30 centrifugal fan systems and 22 multi-zone and air handling units. These 52 systems deliver a total of 860,000 cfm for heating and cooling. This air is distributed through 13 miles of low pressure ductwork and 4 miles of high pressure conduits from 4 to 33 in. in diam. Also, there are 2 miles of flexible air ducts from 4 to 8 in. in diam. As many as 2190 induction units and 3400 air diffusers, registers, and grilles are to be used in this installation.

There will be 23 miles of steam and water piping installed along with 167 steam heating coils which are used for preheat, reheat, and for boosters.

You'll Want To Know

Weld 10 Miles of Pipe For New Ice Rink

THE WELDING of the 1 in. diam wrought iron pipe for the new ice rink in the new $1 million McHugh Forum on the Boston College campus is shown here. Ammonia brine is circulated through the 10 miles of piping for this installation at the rate of 1200 gpm, according to A. M. Byers Co. Since this is a permanent type ice rink, all piping is embedded in concrete. Note steel chairs for supporting pipes on 4 in. centers to assure complete encasement of pipes in concrete. Wood spacers hold pipe in position during welding and are removed before concrete is placed around pipe

Natural Gas Reserves Increased to All-Time High

PROVED RECOVERABLE reserves of natural gas in the U. S. were increased to an all-time high of more than 254 trillion cu ft in 1958, the American Gas Association announced in a report released jointly with the American Petroleum Institute.

The report notes that a net gain of 7.6 trillion cu ft was achieved during the year, even though net production in 1958 amounted to nearly 11.5 trillion cu ft, a figure surpassed only by the all-time peak of 11,502 billion cu ft produced in 1957.

Additions to natural gas reserves during 1958 totalled 19 trillion cu ft, including 5.6 trillion cu ft of new discoveries. Extensions and revisions of earlier estimates amounted to 13.4 trillion cu ft, and an increase of 58 billion cu ft was reported in underground storage.

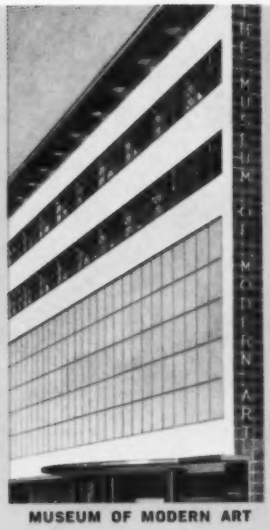
The nation's estimated proved recoverable reserves have increased from 173.9 trillion to 254.1 trillion cu ft since 1948. This net gain of 80.2 trillion cu ft was recorded despite increasing demands. Total production during the same period was 92.4 trillion cu ft.

New discoveries of natural gas liquids reserves in 1958 totalled 108.2 million barrels. Estimated reserves at year's end totalled 6.2 million barrels, an increase of nearly 517 million barrels over the 1957 reserves total.

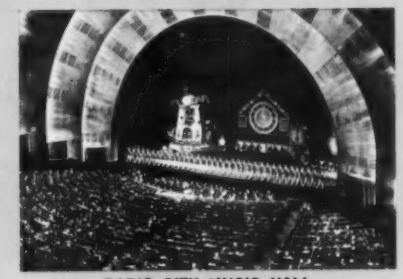
Prominent New York buildings using POWERS CONTROL

and NOW....

UNITED NATIONS, General Assembly



MUSEUM OF MODERN ART



RADIO CITY MUSIC HALL

LEVER HOUSE

CANADA HOUSE

ROCKEFELLER CENTER, 15 Buildings

NEW YORK COLISEUM

NEW YORK STOCK EXCHANGE

NEW YORK DAILY NEWS

POWERS

Air Conditioning Control

NEW EQUITABLE LIFE ASSURANCE SOCIETY BUILDING
NEW YORK CITY

In the World's

100 YEARS OF PROGRESS

EQUITABLE LIFE ASSURANCE SOCIETY
of the UNITED STATES

is the third largest life insurance institution. In 1959 it is celebrating its 100th Anniversary by erecting a new 42 story headquarters building 546 feet high.

With 1,700,000 square feet of floor space it will be the world's largest single occupancy private office building. It is adjacent to New York's Rockefeller Center located on Avenue of the Americas between 51st and 52nd Streets.

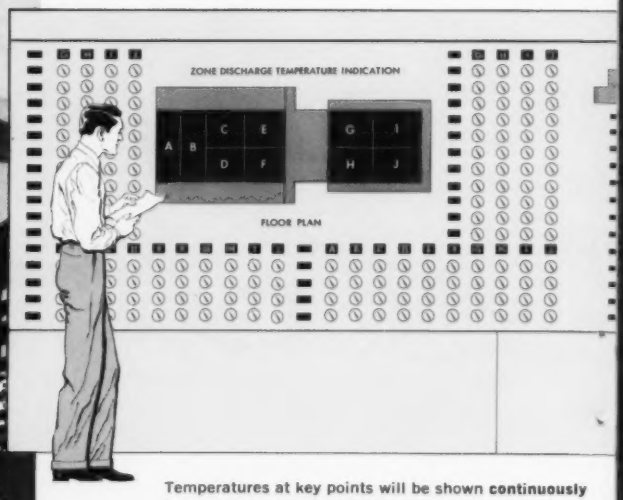
Architects:
SKIDMORE, OWINGS & MERRILL

Mechanical Engineers:
MEYER, STRONG & JONES

General Contractor:
TURNER CONSTRUCTION CO.

Mechanical Contractor:
KERBY SAUNDERS, INC.

Below: Part of the 37 foot long Powers multi-colored control center that will play an important role in efficient supervision and regulation of the 55 air conditioning systems and 19 ventilating units



Temperatures at key points will be shown **continuously** by easy-to-read **pneumatic** temperature gages.

Largest Single Occupancy Tower

POWERS CONTROL

will regulate the Climate of Progress

POWERS
Air Conditioning Control

5772 Induction type Air Conditioning Units

• Proper Thermal Environment for 10,000 employees in its new $58,000,000 headquarters building is important for Equitable's continued growth and progress.

Year 'round air conditioned comfort assured by a Powers Quality System of Temperature Control will help provide the climate conducive to better thinking, better planning and increased productivity of employees.

Around 75 Million cubic feet of conditioned air per hour will be circulated through 55 central systems. 5400 Tons of refrigeration will be provided by 4 centrifugal steam turbine driven compressors.

Perimeter areas will be equipped with 5772 induction type air conditioning units, supplied by 12 air conditioning systems. Powers Heating-Cooling Thermostats controlling PACKLESS Valves will enable occupants of each space to select the temperature desired. Interior areas with moveable partitions to permit rearrangement of rooms if required, will have zone controlled air conditioning supplied by 43 central systems. Powers Series 200 Temperature Regulators and Submaster Regulators will be used for precision control of all air conditioning.

POWERS Graph-O-Matic Control Center, 37 feet long, will provide the nerve center for all temperature, humidity and ventilation control systems. Temperatures throughout all the systems are pneumatically transmitted to this center, and the operator is provided with adequate means for re-setting the control instruments located hundreds of feet away.

In Your New Building – make sure you get the maximum return on the investment in air conditioning. Ask your architect or consulting engineer to include a time proven Powers Pneumatic Air Conditioning Control System.

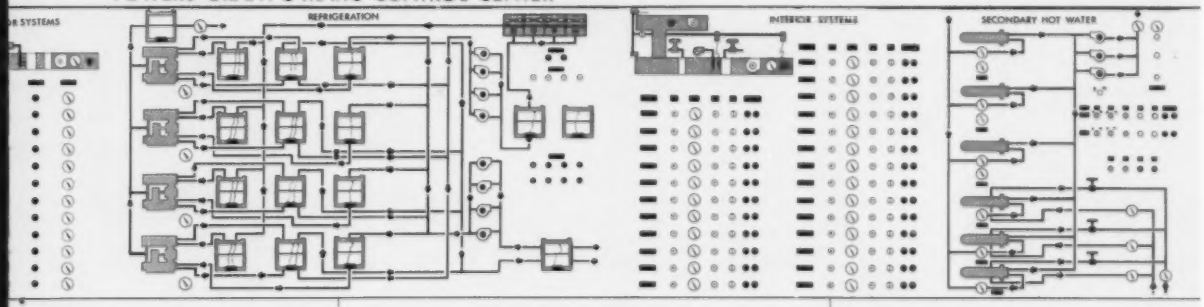
Powers Complete Responsibility for a correctly engineered control system, proper installation, successful operation and SERVICE when required, are your best insurance for dependable year after year performance.

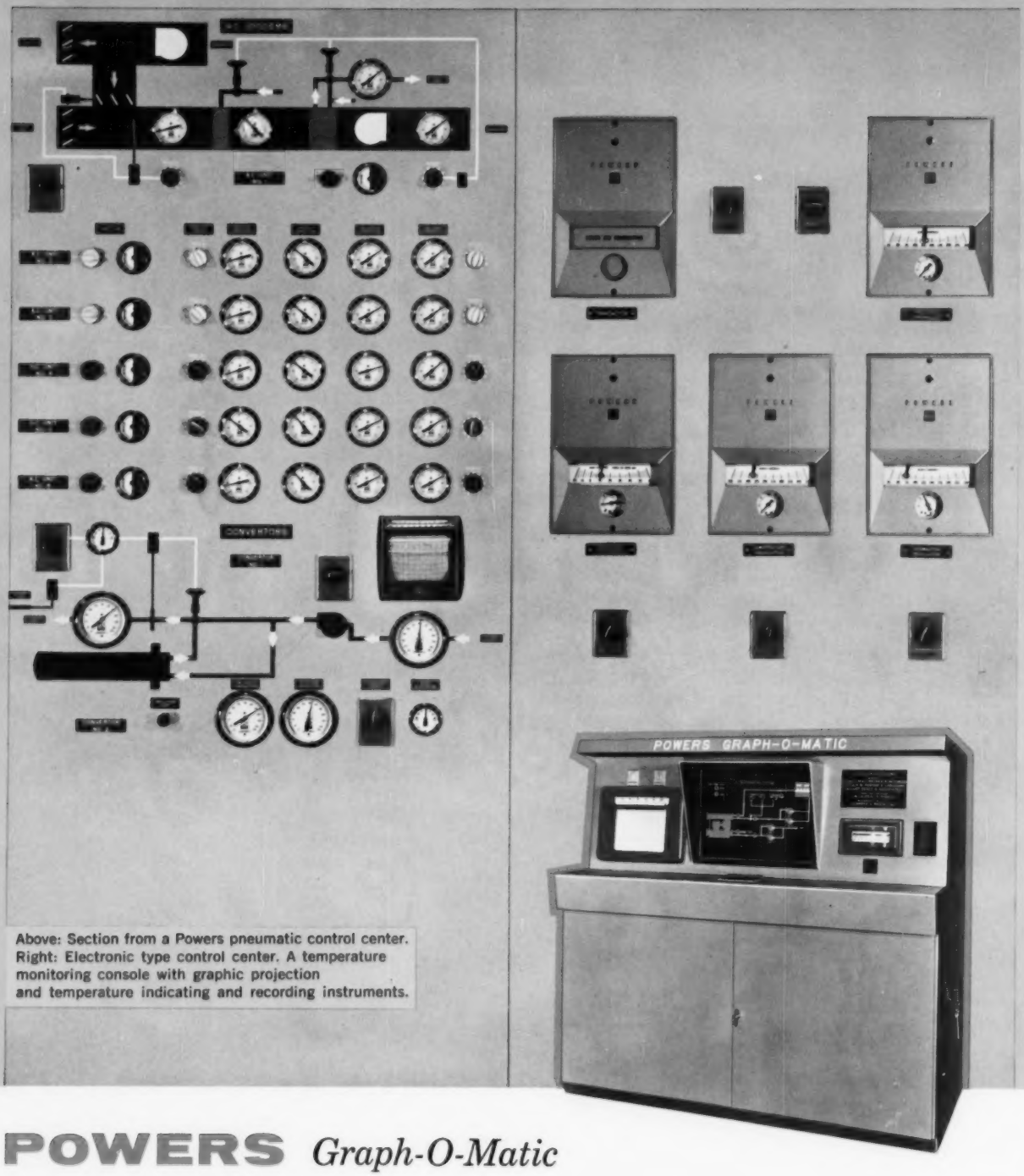
THE POWERS REGULATOR COMPANY

Established 1891 • Factory & General Office, Skokie, Ill. • Offices in 85 Cities in U.S. and Canada

(D-10)

POWERS GRAPH-O-MATIC CONTROL CENTER





Above: Section from a Powers pneumatic control center. Right: Electronic type control center. A temperature monitoring console with graphic projection and temperature indicating and recording instruments.

POWERS *Graph-O-Matic*

Control Centers

combined with a Powers Quality System of Temperature, Humidity and Ventilation Control, provide the ultimate in indoor climate or process automation.

Graphic panels are custom designed to meet the requirements of each installation. Instruments on pneumatic control panels perform many functions. Temperatures at key points throughout a building are indicated continuously and permit engineer to start, stop, supervise and regulate all equipment without leaving the panel.

POWERS Air Conditioning CONTROL SYSTEMS Regulate the Climate of Progress (D-10)

ANSWER TO MANY "IMPOSSIBLE" VENTILATION PROBLEMS

Do you require ventilation for "problem" areas like these:

- Large areas where wall locations are not available?
- Areas where duct work would prove too expensive?
- Areas where ducting would use valuable production space?
- Areas where ducting would prevent periodic layout modifications?

Then packaged "Buffalo" Sky-Vent Power Roof Ventilators are your practical answer. High capacities (1000 thru 250,000 cfm) reduce costs by minimizing number of roof installations. Shipped as ready-to-operate units, they save installation time and money. Husky, durable construction includes integral curb flanges — internally braced hoods to withstand heavy snow loads and hurricane winds — coated with thick cork-impregnated asphalt for corrosion resistance. High efficiency "Buffalo" Fans move maximum air per horsepower. Write for Bulletin FM-2345.

"SHORTCUT" TO MAKE-UP AIR

"Buffalo" Make-Up Air Units are easily-installed, factory assembled "packages" designed to supply high capacity heated and/or filtered air in conjunction with exhaust ventilation. Mounted in roof or wall, they eliminate the need for costly, space-consuming ducts. Highly flexible for installation in new or present buildings. Available with face and by-pass and/or fresh and return air dampers, filters, non-freeze heating coils, propeller fan and motor. Also with reverse design wheels for summer exhaust. Write for Bulletin 2345.

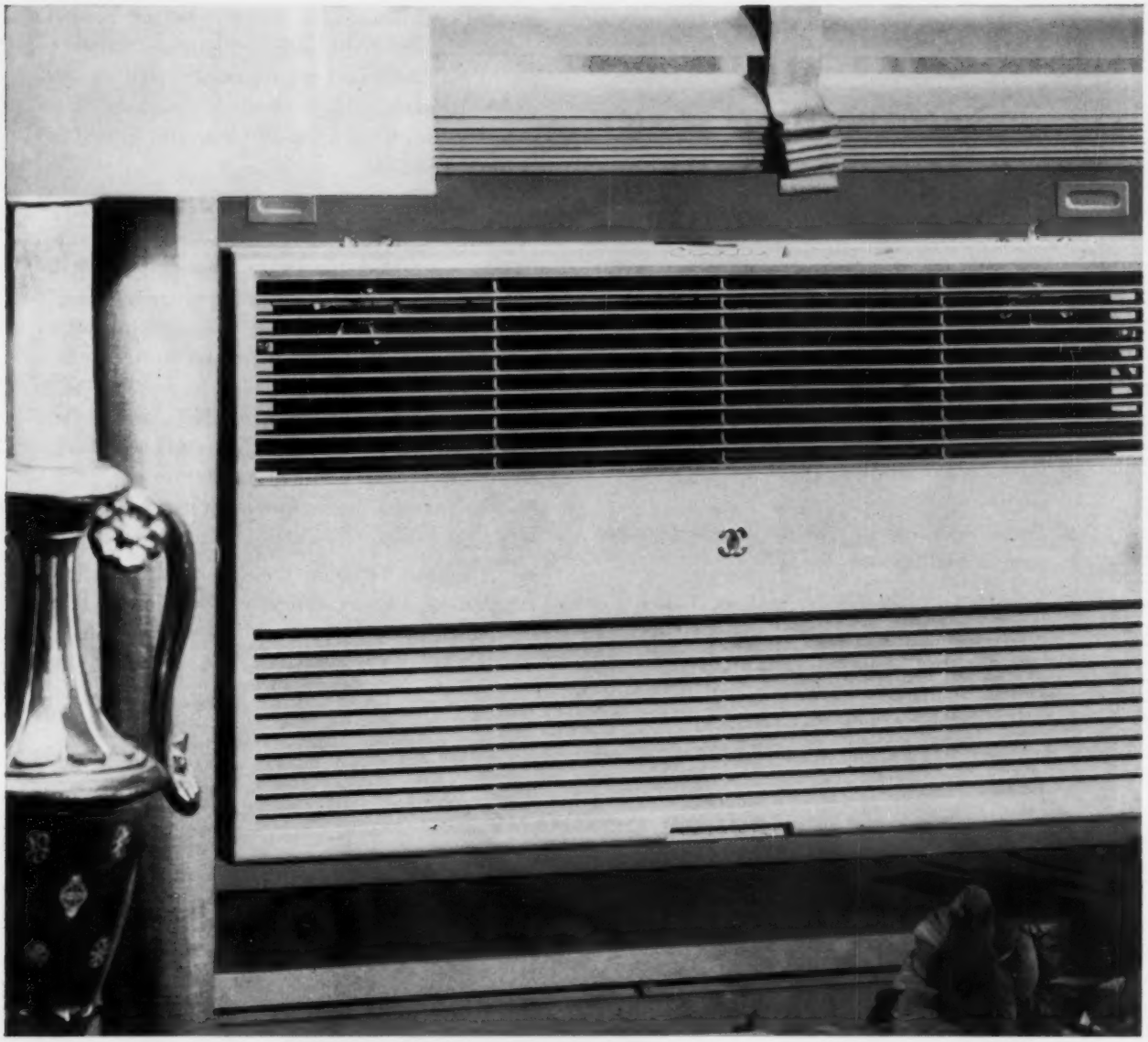
For complete facts on these versatile "Buffalo" ventilating packages, call your "Buffalo" engineering representative — or write for above bulletin.

BUFFALO FORGE COMPANY
Buffalo, N. Y.
Buffalo Pumps Division, Buffalo, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

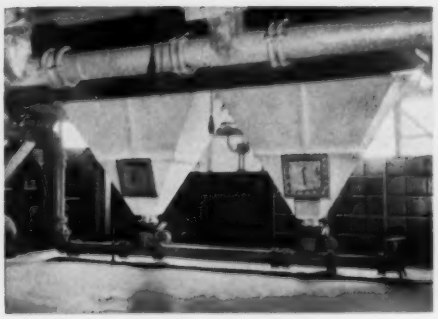
"Buffalo" Make-Up Air Heater Section Under Style "H" Sky-Vent

"Buffalo" Style "H" Sky-Vent Power Roof Ventilators

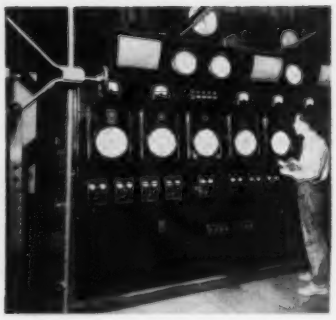
VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT • EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING



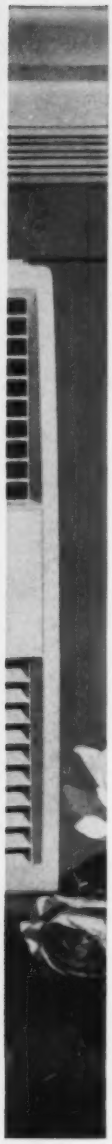
General view of Carrier power plant. Boilers on right are bent tube, two-drum types, by Riley Stoker Corp. burning pulverized coal. Coal moves from bunkers to Riley Pulverizers (at left in photo) and then into furnace.



Mechanical dust collectors by Prat-Daniel Corp. help assure cleanliness of operation. These collectors tie in with United Conveyor ash handling system for movement to ash silo and final disposal.



Pneumatic automatic control panel by Bailey Meter Co. regulates combustion operation of all boilers and auxiliary equipment, maintains continuing steam generation efficiency!



Carrier puts the chill on fuel costs...with coal

Air conditioner manufacturer uses coal for low-cost steam

An unusual team—the heating ability of coal and the cooling facility of air conditioning equipment! Yet Carrier Corporation, Syracuse, N.Y., found this combination profitable when expansion plans required additional capacity in its steam plant. After engineering surveys, Carrier decided to continue burning coal for economy of operation. Today modern power equipment supplies steam *economically* for heating, air conditioning and processing. Original fuel costs plus automatic operation within the power plant hold overall steam costs to a minimum.

Coal is lowest cost fuel

Today, *when the annual cost of fuel often equals the original cost of the boilers,* you should know that bituminous coal is the lowest cost fuel in most industrial areas. And modern coal-burning equipment gives you 15% to 50% *more* steam per dollar, while automatic operation trims labor costs and eliminates smoke problems. What's more, tremendous coal reserves and mechanized mining procedures assure you a constantly plentiful supply of coal at stable prices.

Technical advisory service

To help you with fuel problems, the Bituminous Coal Institute offers a free technical advisory service. We welcome the opportunity to work with you, your consulting engineers and architects. If you are concerned with steam costs, write to address below or send coupon. Ask also for our case history booklet, complete with data sheets. You'll find them informative.

Consult an engineering firm

If you are remodeling or building new heating or power facilities, it will pay you to consult a qualified engineering firm. Such concerns—familiar with the latest in fuel costs and equipment—can effect great savings for you with the efficiency and economy of coal.

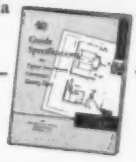
BITUMINOUS COAL INSTITUTE

Dept. HP-04, Southern Building, Washington 5, D. C.

See our listing in *SWEET'S*

Coal is loaded into silos before it moves to bunkers. At left is the ash silo which utilizes rotary dustless unloader in loading trucks for disposal. Silos and conveyors are by Fairfield Engineering Co.

SEND COUPON FOR NEW BCI PUBLICATIONS. Guide Specifications, with complete equipment criteria and boiler room plans:



BITUMINOUS COAL INSTITUTE,
Southern Building, Washington 5, D. C.

Gentlemen: Please send me: HP-04

☐ GS-1 (low-pressure heating plant, screw-type underfeed stoker); ☐ GS-2 (high-pressure heating and/or process plant, ram-type underfeed stoker); ☐ GS-3 (automatic package boiler for heating and process plants). ☐ Case histories on larger plants.

Name_____

Title_____

Company_____

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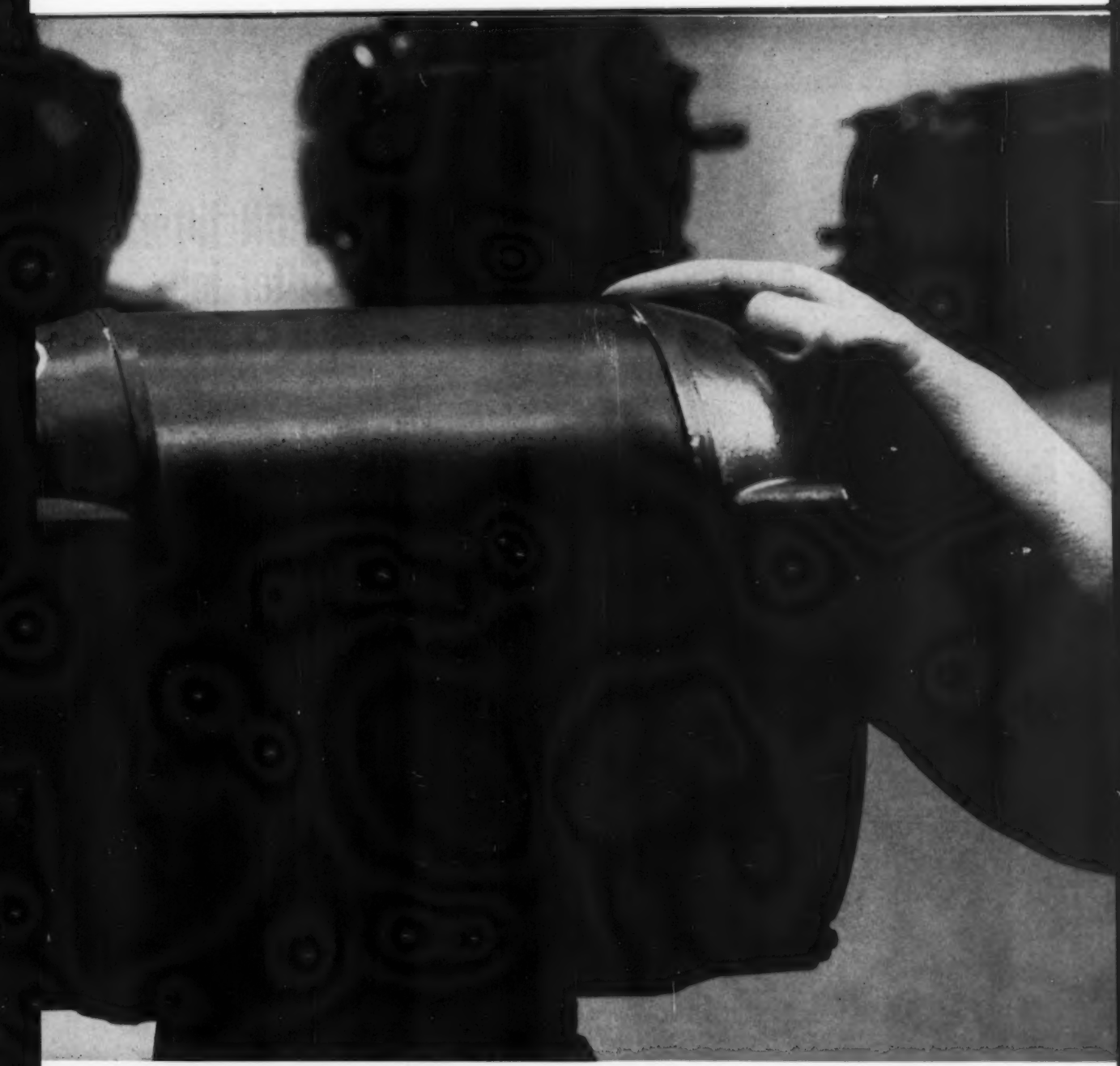
For more than just a motor

Solve your motor problems with

You can make your job easier with Century Electric's complete line of fractional-horsepower motors. Here's how:

Easy ordering—You save time because you get answers to all motor problems from one source. This means you don't have to shop around for the motor you need. You name it—capacitor, jet pump, unit heater, oil burner, brake, gear—any one you want, and in all types of enclosures too.

Fast shipments—From Century Electric's complete stock you can get a motor for any standard application. In addition, motors are packed in sturdy boxes so if you reship you know they'll arrive in good condition.



Century's complete fractional line

Application know-how—You want to be sure you have the *right* motor for the job. And if you need expert help, you can get it from your nearest Century Electric sales engineer. He knows motors inside and out because he sells, applies and thinks motors day after day.

This is why you get *more* than just a motor from Century Electric. You get a quality product, fast answers and engineering application know-how on motors up to 400 hp—all from one source.

CENTURY ELECTRIC COMPANY

St. Louis 3, Missouri *Offices and Stock Points in Principal Cities*

Century

55-19

Now—

a new PLIOTRON filter for every filter job

at ordinary filter prices

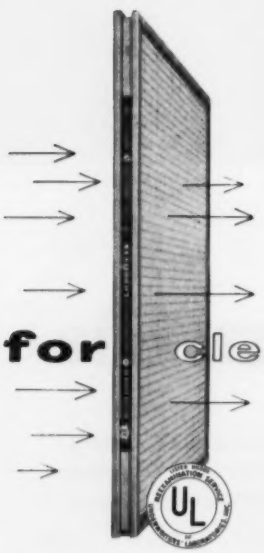
The new PLIOTRON CR filters do an unmatched air-cleaning job in all normal installations. They clearly outscored competitive makes in dirt-arrestance tests. And they're available in both regular and special sizes.

Then, for critical installations that call for a maximum-efficiency filter, there's the new PLIOTRON HD. It's the most efficient panel filter ever developed.

PLIOTRON filters are not ordinary surface-loaders—they're depth-loaders. Their electrostatic action helps *trap* the dirt ordinary filters only *sift*. And they last indefinitely—a quick bath will restore them to like-new efficiency.

Word quickly gets around on super-filters like these—one installation sells another and another. So it's easy to see what business-builders the complete new line of PLIOTRON filters promises to become.

For the complete story on the new PLIOTRON CR and HD filters – covering every filtering requirement—write Goodyear, P.O. Box 288, Akron, Ohio.



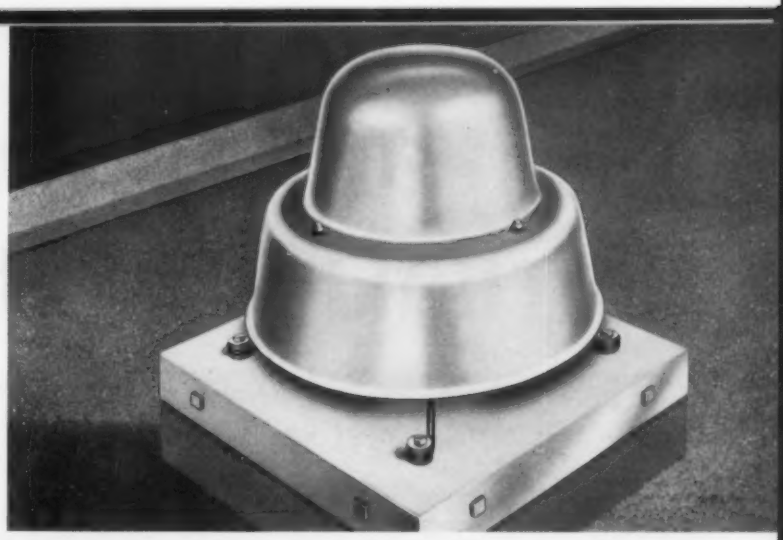
for cleaner air everywhere-

NEW **PLIOTRON** AIR FILTERS BY

GOODYEAR

THE GREATEST NAME IN RUBBER

Pliotron—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio



Centrifugal Roof Ventilator provides quiet, high-volume ventilation. Streamlined, compact, easy to install. Inlet cones and wheel rims are aerodynamically correct, provide smooth air flow, quiet operation. Resilient mounting minimizes vibration. Unit shown has maintenance-free, weatherproof spun aluminum housing. Complete range of 16 fan sizes from 7″ to 40″ wheel.

Now! All your ventilator needs from one reliable source - Trane!

New sidewall ventilators make the Trane line more complete than ever!

When you need a ventilator—centrifugal or axial roof or sidewall—for school, commercial, factory or warehouse application, you can choose the one you need from the complete TRANE line. There are models to handle any large building ventilating problem—including venting of explosive and corrosive fumes and gases. And these TRANE ventilators are easy to install, easy to maintain. Motors are readily accessible for inspection and service.

Other TRANE ventilating equipment includes the famous Torrivent that heats and ventilates; TRANE Coils; a complete line of Class I, II and III Fans; TRANE Utility Fans and Cabinet Fans.

So when you plan your next ventilating installation, turn to TRANE. One reliable source for the equipment you need pin-points responsibility, simplifies ordering and delivery, too. For complete specifications on TRANE ventilators, call your nearby TRANE Sales Office. Or write TRANE, La Crosse, Wisconsin.

Sidewall Ventilator handles large volume of air against static pressures. Exclusive bottom louvered discharge away from building provides positive protection against driving rain and snow. Cap and base are of lightweight, weatherproof spun aluminum. Complete range of sizes, 7″—15″ wheel.

Axial Roof Ventilator features exceptionally low silhouette. Aerodynamically correct inlet and hood design provides highly efficient movement, reduces power consumption. Available for exhaust or summer supply. Also vertical exhaust type to discharge hot or dirty air straight up, away from roof.

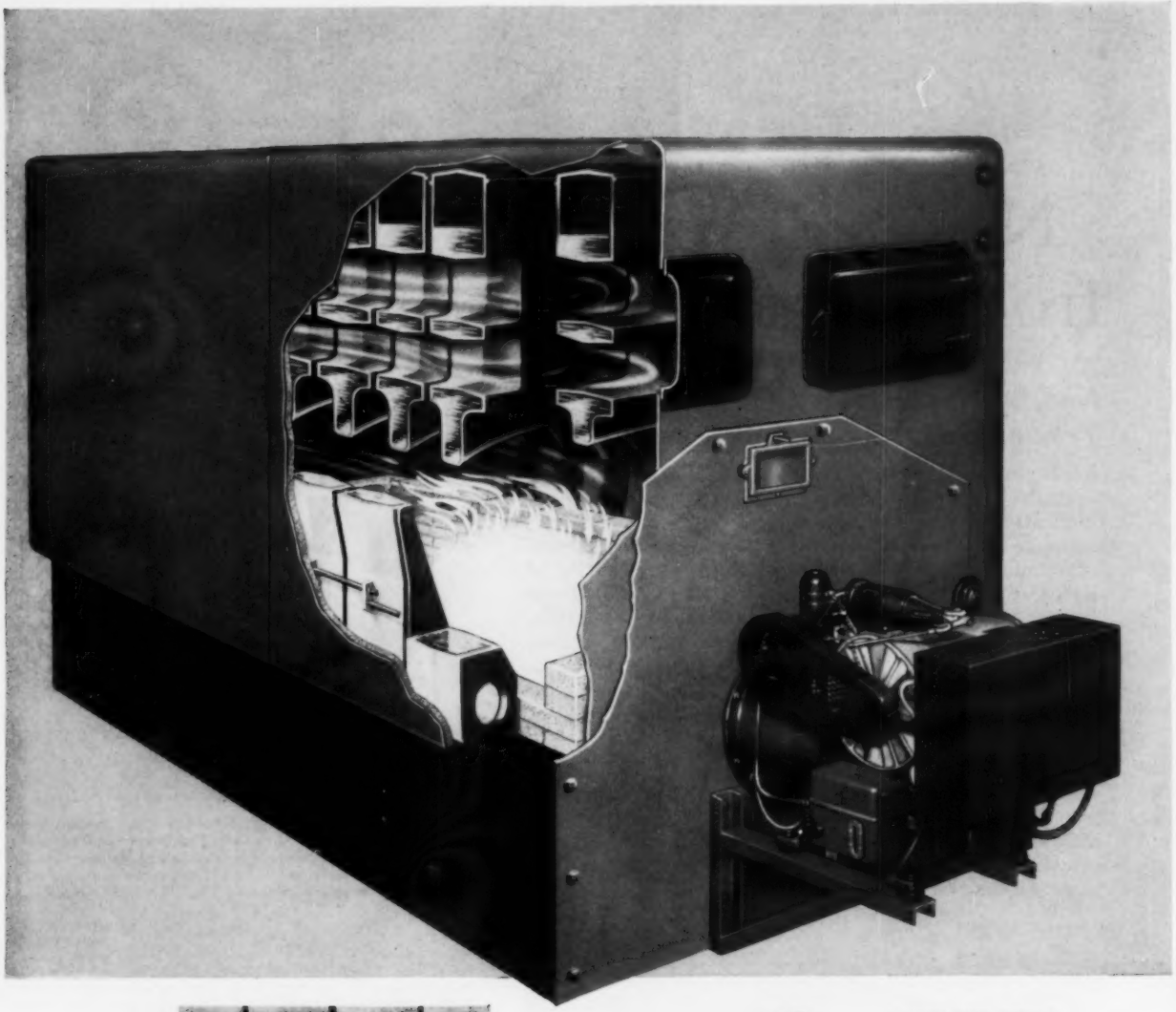
For any air condition, turn to

TRANE

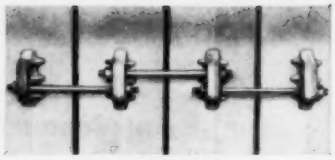
MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. • CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO • 97 U.S. AND 19 CANADIAN OFFICES

THE FIRST CAST IRON FOR NO. 5 OIL OR



FEATURES FOR EASIER ERECTION



SHORT DRAW-RODS

Multiple short draw-rods are used to tie the sections together. This assembly equalizes the stress between sections—permits easier, faster erection.

Sections are *not* face-ground—the tough outer skin of cast iron is left intact to protect against corrosion. Spaces between sections are made gas-tight with asbestos cement.

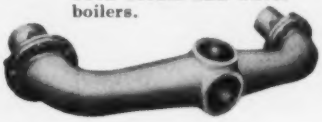
Steam supply header

Steam or hot water return header

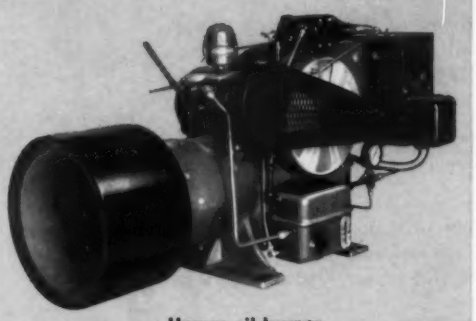
"EASY FIT" STEAM SUPPLY HEADERS

Flexible in all three directions! Permits normal expansion and contraction of the header parts without setting up stresses on any one part.

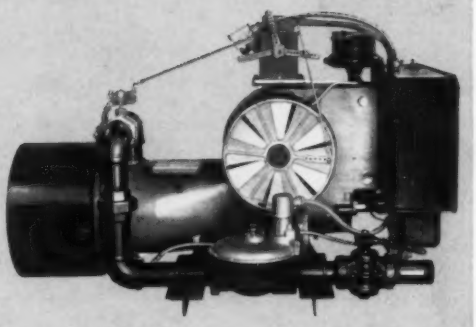
Cast Iron Return Headers are also available for both steam and water boilers.



BOILER-BURNER UNITS
COMBINATION GAS–LIGHT OIL



Heavy oil burner



Combination gas—light oil burner

in a capacity range of 3,395 to 12,260 sq. ft. of steam

These new Weil-McLain units offer all the operating economies which only modern *cast iron* boilers equipped with the latest design firing devices can provide. They are furnished with air atomizing, pressure type burners, completely integrated with the most up-to-date electronic controls and factory-engineered combustion chamber design.

The Oil Heating Units, while primarily designed to burn low-cost No. 5 oil, will efficiently handle all grades of lighter oils. The combination Gas—Light Oil Units can burn either gas or No. 2 fuel oil.

The efficient performance of Weil-McLain Boilers is a well established fact. When fired with these modern burners, an unusually high degree of economy is assured.

Heavy Oil Burners

These burners are capable of burning Nos. 1, 2, 4 or 5 oil and furnish all the air needed for combustion. The accurately metered, intimate mixture of air and heavy oil into a highly combustible spray or fog in the nozzle is the key to superior performance. Burners start with small flame which gradually and smoothly builds up to proper size. Electronically controlled for safe operation.

Combination Gas—Light Oil Burners

These units combine a power gas burner and a high pressure air atomizing burner. High efficiency is assured by correct metering of air and fuel. For both gas and oil operation, burner starts with small flame and builds up to required size. Electronically controlled, with pre-purge and post-purge...manually or automatically changed from one fuel to another.

For complete information, send for Bulletin C-272. For information on other Weil-McLain Gas and Oil Boilers, see Engineers' Product File or Sweet's Architectural File.

BURNER SERVICE PROVIDED FOR ONE YEAR, INCLUDING START-UP

WEIL-McLAIN

ICH AND ICL 40 AND 44 BOILER-BURNER UNITS

FOR COMMERCIAL AND INDUSTRIAL HEATING SYSTEMS

WEIL-McLAIN BOILERS and RADIATORS

WEIL-McLAIN COMPANY
MICHIGAN CITY, INDIANA

Address literature requests to Dept. AA-49

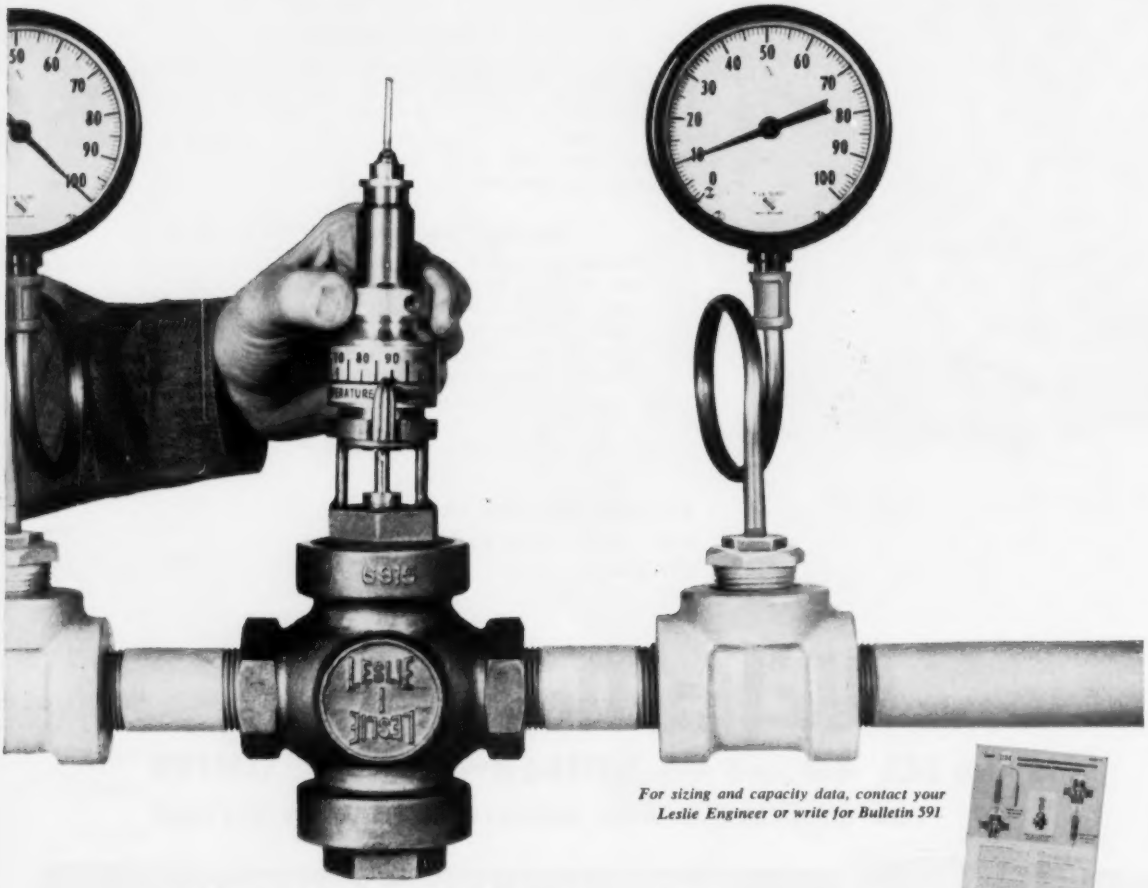
accuracy, reliability
ENGINEERED INTO LESLIE'S COMPLETE

NEW SINGLE-SEATED, BALANCED DISC, TEMPERATURE REGULATOR HANDLES INLET PRESSURES TO 100 psi.

New Leslie regulator can handle inlet pressure and pressure drops to 100 psi. High power, positive movement of an actuating bellows with solid liquid fill, and the virtually friction-less stuffing box provides stem movement exactly proportional to the temperature change at the bulb.

Designed for steam or water service, it features a single seated, self-aligning, tight closing inner valve. (Units can be changed in the field from direct to reverse acting, or from reverse to direct acting, simply by inverting body and main valve.)

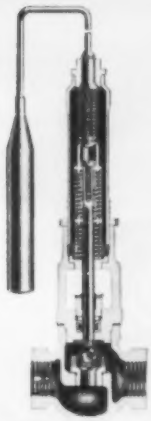
Applications include instantaneous heaters or coolers—shell and tube or shell and coil heat exchangers; storage or tank heaters; and, process heaters or coolers of all types. Available in cast iron or cast bronze bodies for temperatures to 450°F. Sizes ¾ and 1", screwed connections.



For sizing and capacity data, contact your Leslie Engineer or write for Bulletin 591

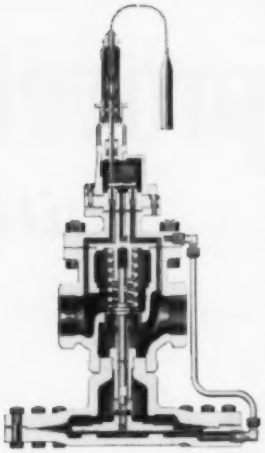
LINE OF TEMPERATURE REGULATORS.

OTHER VERSATILE LESLIE REGULATORS PROVIDE PRECISE TEMPERATURE AND PRESSURE CONTROL.



Bellows Operated Temperature Regulator For Small Flows

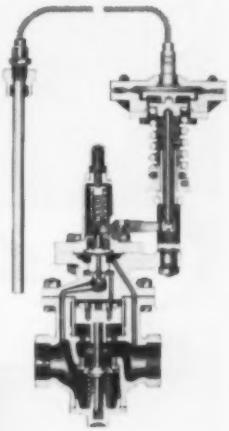
Direct Operated Design is used for small flow heating and cooling service, size ⅜, ½ and ¾". Liquid filled thermostatic element supplies ample power to stroke the single seated main valve. Valve travel is directly proportional to temperature change at bulb. This design is suitable for instantaneous and storage type heaters. It is also available in double seated construction for cooling service.



Class TKM Pilot Actuated, Metal Diaphragm Operated Temperature Regulator

Pilot Operated, Single Element Control also uses the liquid filled element to operate pilot device which applies operating pressure from the regulator inlet to a diaphragm for stroking main valve in heating or cooling service. Large diaphragm area and operating pressure supply ample power for controlling long stroke, single seated main valve with full flow capacity in sizes ½-4". Regulator has a 3 to 5° throttling range and is suitable for all storage type heat exchangers and for any system requiring on-off control.

Class LTCO Pilot Actuated, Piston Operated Temperature Regulator



Pilot Operated, Duo-Matic (two-element control) design offers both temperature and pressure regulating functions in a pilot actuated, piston or diaphragm operated regulator. The valves can handle a range of inlet steam pressures in heating services from 25 to 600 psi and controlled pressure ranges of either 2 to 15 psi or 10 to 250 psi. These characteristics are ideal for all storage type heaters and most instantaneous heater problems. Available in sizes ¼-6" with iron, bronze and cast steel construction.

For complete sizing and capacity data, write for Bulletin 5307-A.

TRADE LESLIE MARK

REGULATORS and CONTROLLERS

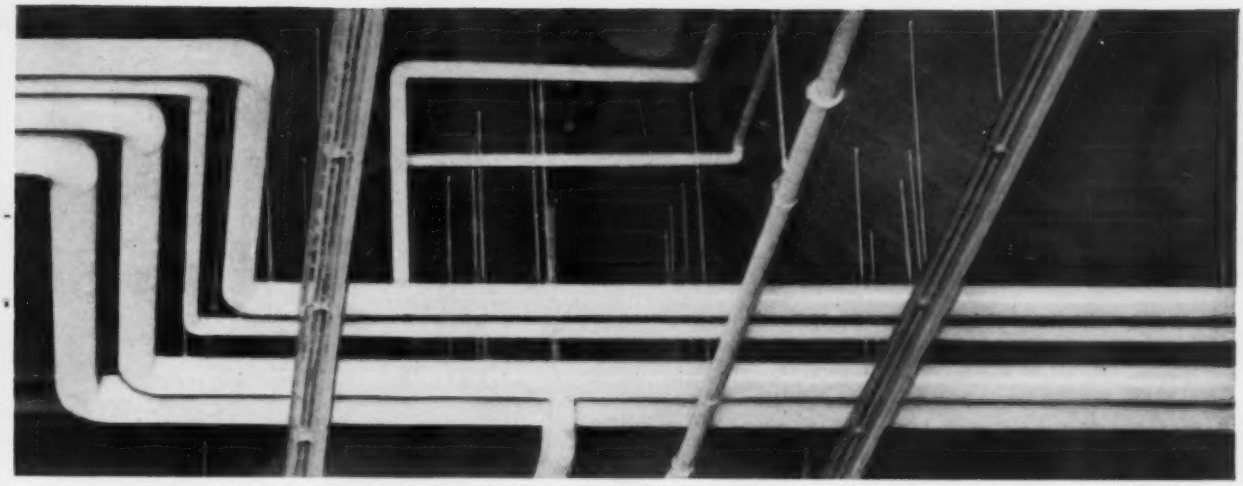
Leslie Co.,437A Leslie Building, Lyndhurst, New Jersey

Over 275 Factory-Trained Engineers At Your Service—Nationwide!

Improved
...with

One look and you know it's Fibrocel ...the only molded insulation for commercial pipelines...in attractive new VS and VB jackets.

Installs easier, faster . . . because its size and shape never vary. Butt straps go on easier, too.



JOHNS-MANVILLE ANNOUNCES . . .

Fibrocel Insulation

2 new types of white jacketing

Easier to install • More attractive • Thermally effective • Priced low for substantial savings

TEST IMPROVED new Fibrocel®—even on just a short run of pipe—and see the difference! See why this rigid, molded insulation makes an installation so many ways better!

First thing you notice about Fibrocel is that it's molded. For only an unvarying metal mold can produce such nearly perfect roundness, such uniformity of size and shape. The result—less time needed to get the neater, better fitting job you want . . . with the pipeline always dead centered in the insulation for top insulating value.

Rigidity is another Fibrocel advantage. Working with a rigid material, butt straps go on easier, faster. And your inspection (whether one day or one year after installation) reveals not a sign of denting, bulging or "fish mouthing"—so common with soft insulations.

New White Jackets

Fibrocel now comes in virtually any jacket you'll ever need. *New Type VS* is richly creped, pure white kraft backed by 1/3-mil foil. One painting provides complete coverage. Yet it's priced as low as canvas. Then, there's new *Type VB*. Priced slightly higher—but well worth it! Outer surface has same rich creping as Type VS, inner vapor barrier is full mil thickness of aluminum foil, pipe facing is creped black kraft. Creping permits surfaces to "move" with foil as moisture conditions vary. Fibrocel is also available with "Type C" canvas finish.

Let us send you a copy of IN-155A, the informative 8-page Fibrocel folder. Write for it today. Address Johns-Manville, Box 14, New York 16, New York. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE

More attractive. Rigid, dimensionally uniform, Fibrocel fits tighter, neater. Jacket doesn't dent, bulge or "fish mouth."

Insulates better. Because Fibrocel is perfectly round, pipe is always "dead center," for maximum insulating value.

Costs less. Don't let Fibrocel's appearance and efficiency mislead you. It's priced low!

Takes abuse . . . in rough service . . . keeps its "just installed" appearance through years of service.

Now we're cooling with **GAS**

A 22-foot wall of sheer glass... yet it's always cool inside! – thanks to GAS-operated Arkla-Servel air conditioning

The strikingly modern Hillside Church is one of four completely air-conditioned buildings in Rose Hills, Southern California's beautiful memorial park. Because of the liberal use of glass walls, and the desire for one central system, the air conditioning installation presented unique problems.

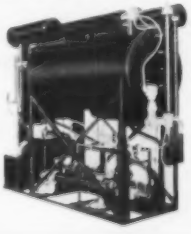
After a careful study, the Arkla-Servel gas absorptive cooling system was chosen. "And we're com-

pletely satisfied," says John D. Grigg, President. "Our 25-ton gas unit produces 10,000 cubic feet of cool air per minute. And you can't beat it for economy. It requires practically no maintenance. Since it uses the same boiler, it makes use of our heating facilities on a year-'round savings basis."

Gas absorptive cooling can put your heating plant on a year-'round economical basis too. For specific information, call your local gas company, or write to the Arkla Air Conditioning Corporation, General Sales Office, 812 Main Street, Little Rock, Ark. *American Gas Association.*

GAS OPERATED ARKLA-SERVEL
ABSORPTION-TYPE WATER CHILLER

- lowest operating costs
- fully automatic operation
- long dependable service
- packaged construction
- compact size
- easy installation



Expansion and contraction of the plastic pipe is controlled by rubber shock cords connected to hooks on the rink rim.

Skating Rink—Dance Floor features freezing system of polyethylene pipe

At this convertible ice skating rink, installed by the Kalamazoo, Michigan, Parks Department, city residents can frolic all year 'round.

Eleven miles of USS National Polyethylene Pipe, NSF Grade, make up the brine-circulating system—3,700 gallons of brine at 35 psi. The lightweight plastic pipe can be removed in just one day to permit dancing or roller skating on the rink's smooth floor. When not in use, the pipe, with 2,640 gallons of the brine still in it, is stored in a trench next to the rink.

Installation of the pipe was completed in two days by a crew who had no previous experience installing a freezing system of polyethylene pipe. The pipe has a 1" inside diameter and a wall thickness of only 1/10 of an inch. Its glass-smooth inner walls greatly reduce friction and minimize pumping problems. When the pipe is disconnected in the Spring, each 185-foot loop, including the brine, will weigh about 110 pounds—light enough to permit easy handling by a small crew.

USS National Polyethylene Pipe, NSF Grade, can't be harmed by most acids, salts, alkalis or other chemicals. It remains flexible in temperatures from −90°F. to +120°F. The pipe is made from 100% virgin polyethylene to which 2% of an inert black pigment filler has been added to prevent deterioration from ultraviolet rays.

For full information, write to National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pa. Ask for Bulletin No. 29. *USS and National are registered trademarks*

"The world's largest and most experienced manufacturer of tubular products"

National Tube Division of USS United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • United States Steel Export Company, New York

HONEYWELL ANNOUNCES

the most recent development in centralized temperature control

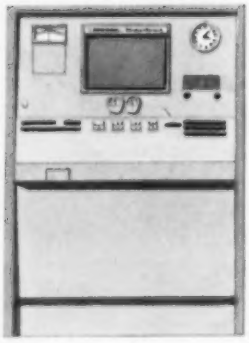
NEW SELECTOGRAPHIC SUPERVISORY DATACENTER*

Honeywell's revolutionary temperature control console features floor plan and system projection. It automatically gives a visual picture of an entire air conditioning system's operations in even the largest buildings.

It provides operating efficiency, better use of specialized manpower, longer equipment life, attractive display of engineering design and more comfortable buildings—all from a standard unit only 4′ wide, 4′ high and 2′ deep.

The Selectographic Supervisory DataCenter is a significant advance in a concept pioneered by Honeywell, whose central control panels are now being used in all kinds of buildings: hospitals, banks, schools, theatres, office and industrial buildings, hotels and motels.

*Trademark



CENTRAL SELECTOGRAPHIC PANEL

Replaces system diagrams and floor plans that take up much of the area on present panels. The desired diagram or floor plan is flashed on one screen. At the same time console controls—single set of push buttons—are automatically switched to control the system in view. They provide precision temperature indication, logging and adjustment plus start and stop control of fans and positioning of dampers.

TEMPERATURE, HUMIDITY RECORDER

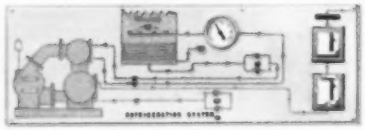
These recorders provide exact printed records of temperatures and humidity throughout the system. These records may be studied to determine over-all system efficiency. Through a plug and jack system one recorder can record up to 20 different measurements on a single chart. Points can be selected so that only those of interest at the time need be recorded.

NEW SELECTOGRAPHIC SUPERVISORY DATACENTER

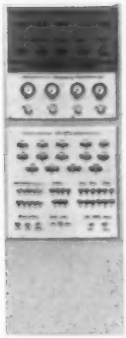
MODULAR CONSTRUCTION, FLOOR PLAN AND SYSTEM PROJECTION MAKE CENTRALIZED CONTROL EASIER TO DESIGN, INSTALL, OPERATE

Now an air conditioning engineer can "see" up to 50 separate fan system diagrams and floor plans, read and adjust critical temperatures throughout a multi-story building ...all at one small console.

In addition to the Selectographic projection feature, Honeywell's modular *building block* design brings new flexibility, new economy to centralized air conditioning controls. Starting with the basic unit—the central Selectographic Console—other modules of a standard 2′ x 2′ dimension may be added as the need arises or as the budget permits. Honeywell's Selectographic Supervisory DataCenter can be installed in buildings of all sizes, of all purposes—and grow with the structure itself.



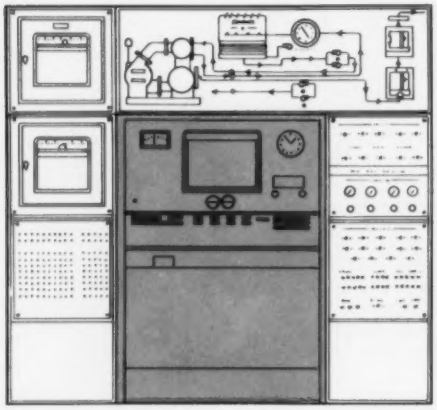
REFRIGERATION PANEL All major electrical accessories of refrigeration system can be started and stopped from this panel. Where the systems require it, the chilled water temperature can be controlled by a precision continuous recording controller in the chilled water supply line. A second controller may indicate and record system output in BTU's. The total BTU output is shown on a numerical counter which can be compared to the total electrical input shown on a similar counter to analyze system efficiency.



ALARM AND ANNUNCIATOR SECTION

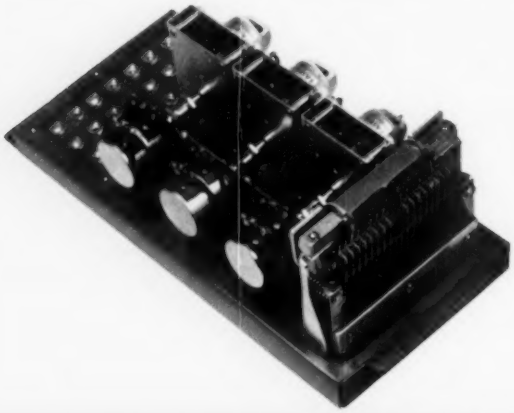
This module contains all air conditioning and refrigeration system alarm pilot lights and equipment operation pilot lights. In addition it may contain cold storage or special climate room limit alarms and other temperature, humidity, flow and pressure monitoring alarms as required.

HOW THE SELECTOGRAPHIC WORKS



NEW PROJECTION SYSTEM STORES ENTIRE BUILDING'S FLOOR PLAN IN CIRCULAR FILE OF 50 SLIDES READY FOR INSTANT SCANNING

The 50-slide projector is operated by pushing a button. Desired floor plan or system diagram shows on the screen; consoles of push buttons then are automatically switched to control that plan or system. One set of push buttons will cause the temperatures at the check points on the plan to be indicated on the console. Simply pushing the proper increase or decrease button will adjust or reset one or all of the thermostats on the plan except those in private spaces. Pushing a similar set of buttons will start and stop all supply and exhaust fans; another set will position all dampers.



MULTIPLEX UNIT

The ability to control an entire system by one set of buttons is made possible by this Honeywell Multiplexer—a multipole bar relay energized by the same button as the projector. All temperature control points and sensing points are connected through this bar relay to the control buttons on the console. Wiring is simplified and substantially reduced.

MORE THAN 400 CONTROL CENTERS using the basic principles outlined here have given improved operating efficiency, better use of specialized manpower, longer equipment life, operational savings and more comfort to hospitals, schools, hotels, office and industrial buildings, banks, shopping centers and churches. A Honeywell control specialist will be glad to work with architect or engineer even before blueprints are started. At this stage his knowledge will be most useful in designing and installing a system that will give the greatest possible satisfaction to all concerned. For more information send the coupon or call one of the 112 local Honeywell offices across the nation.

CLIP AND MAIL COUPON FOR DETAILED SPECIFICATIONS

Honeywell

First in Control

HONEYWELL
DEPT. SDC110
MINNEAPOLIS, MINNESOTA

Gentlemen:

Please send me detailed specifications on Honeywell's new Selectographic Supervisory DataCenter.

NAME_____

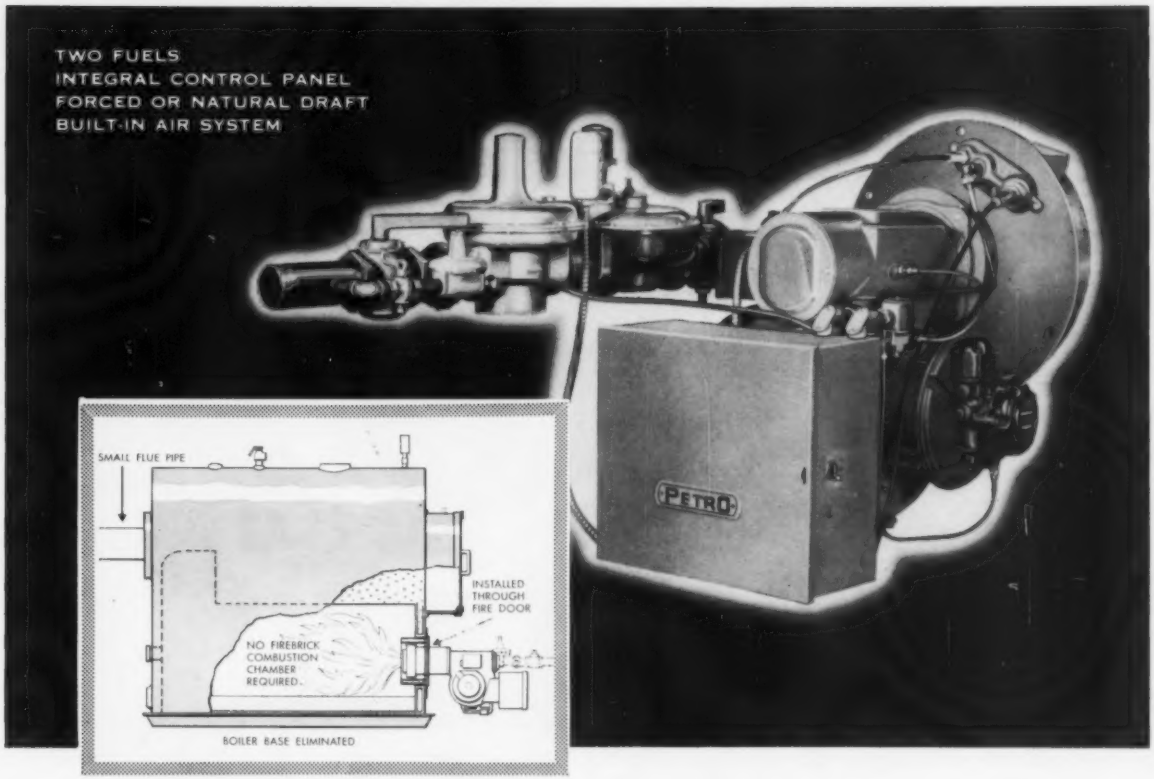
FIRM_____

POSITION_____

ADDRESS_____

CITY_____ STATE_____

New all-in-one burner *bolts to boiler front*



Average installation saving in firebox boilers: $250

Substantial savings in installation costs are made possible in a firebox boiler by the elimination of the boiler base and fire brick combustion chamber. Fits any boiler; bolts to the boiler front. Complete forced draft, fuel and control systems are built into the burner. No secondary air construction needed.

Also available as boiler-burner unit

Packaged boiler with integral burner can be delivered at site, ready for service connections. No brickwork, pit, or special setting required.

No high stack needed

In a sealed fire box no stack is required; merely a vent. Air is supplied under forced draft. In conventional boilers the stack can be shorter and smaller than required by the usual gas or oil burner.

Switches fuels instantly

Burns either fuel with high efficiency. Saves purchase of extra burner in areas where gas users must provide standby oil equipment. One-fuel models are also available for either gas or oil.

Cuts fuel costs

New type of burner head and improved fuel-air control develops exceptional combustion efficiency. Instant heat absorption. No wasteful refractories to heat up.

Costs less to operate

Requires no more supervision than a domestic burner. Maintenance problems are negligible, and can usually be handled by the janitor.

Capacities: oil, 4 to 30 gph; gas, 500,000 to 4,000,000 btu/h.

Send coupon for full description and specifications

Makers of Quality Heating and Power Equipment since 1903

PETRO

T. M. REG. U. S. PAT. OFF

PETRO, 3331 W. 106th Street, Cleveland 11, Ohio
(In Canada: 80 Ward Street, Toronto, Ontario)

Please send complete information on Petro P-240 dual-fuel burner and boiler-burner units.

Name_____

Company_____

Address_____

City_____ State_____

easy to handle!

Easy and Safe to Carry

Ring-top provides a solid, generous hand-hold—more than 4" to grip, reducing risk of cylinder damage or personal danger. No more hunting for separate carrying devices!

new ring-top cylinders

exclusive with Ucon BRAND refrigerants

Ucon Refrigerants 12, 22 and 114 Are Now Available in 10 and 25 Pound Ring-Top Cylinders for Easy Handling... Fast, Convenient Inventory!

Makes Service Jobs Easier

Inverted cylinder stands alone. Any standard wrench operates valve. Install flexible tubing and forget it until cylinder is empty.

Color-Coded at the Top

Big colored top section makes it easy to check your stock of Ucon Refrigerant grades... at a glance. No cylinder caps to keep track of.

Made in Five Top-Quality Grades, Ucon Refrigerants 11-12-22-113-114 meet your strictest standards for dryness, purity and economy.

Full Choice of Unit Sizes to match *your* quantity needs. Ucon Refrigerants are sold in 10 and 25 pound Ring-Top Cylinders, in 145 pound and ton cylinders, in 100 and 200 pound drums, and in tank-wagon or tank-car lots.

Prompt, Efficient Delivery from the largest network of distribution points in America serving the refrigeration and air conditioning industries.

Get Full Data on Ucon Refrigerants now! See your wholesaler, or write: Ucon Refrigerants, Union Carbide Chemicals Company, 30 East 42nd Street, New York 17, N. Y. Call, write or wire us, any time. Attention, Dept. F-4.

Ucon and Union Carbide are registered trade marks of Union Carbide Corporation.

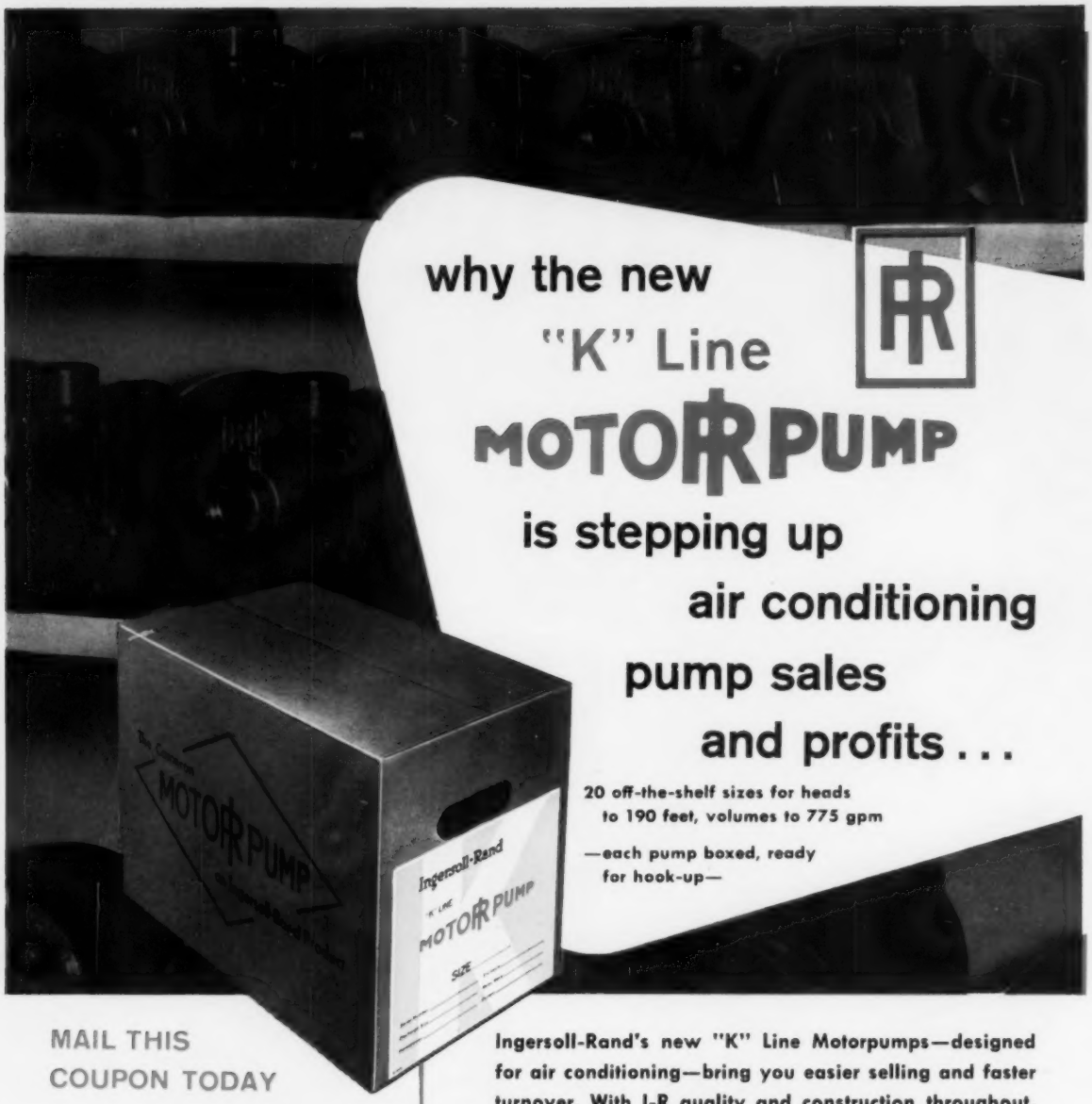
Ucon BRAND refrigerants

These 5 Ucon Brand Refrigerants will meet your refrigeration and air conditioning needs

Ucon Refrigerant 11 Trichloromonofluoromethane
Ucon Refrigerant 12 Dichlorodifluoromethane
Ucon Refrigerant 22 Monochlorodifluoromethane
Ucon Refrigerant 113 Trichlorotrifluoroethane
Ucon Refrigerant 114 Dichlorotetrafluoroethane

UNION CARBIDE CHEMICALS COMPANY

Division of Union Carbide Corporation



why the new "K" Line MOTORRPUMP is stepping up air conditioning pump sales and profits . . .

20 off-the-shelf sizes for heads to 190 feet, volumes to 775 gpm

—each pump boxed, ready for hook-up—

MAIL THIS COUPON TODAY

See how the new "K" Line Motorpumps can give you easier sales, higher profits.

Ingersoll-Rand Co., Merchandising Division
11 Broadway, New York 4, N. Y.

Gentlemen:

Please see that I receive full details on the profitable new "K" Line Motorpump.

Name_____

Company_____

Address_____

City_____ Zone____ State____

Ingersoll-Rand's new "K" Line Motorpumps—designed for air conditioning—bring you easier selling and faster turnover. With I-R quality and construction throughout, new "K" Line Motorpumps offer these definite advantages:

- New Marketing Policy—Important advantages to help you meet the growing need for quality pumps at volume prices for volume sales.
- Minimum Inventory—20 "K" Line Motorpump sizes give complete hydraulic coverage, meet *every* requirement for volumes to 775 gpm, heads to 190 feet.
- Simplified Selling—I-R "K" Line Selection Charts tell you instantly the *right* pump size for any requirement.
- Customer Acceptance—Universally known Ingersoll-Rand quality means instant recognition and acceptance.
- Immediate Availability—"K" Line Motorpumps are available now for shipment. Each pump is boxed, ready for hook-up.

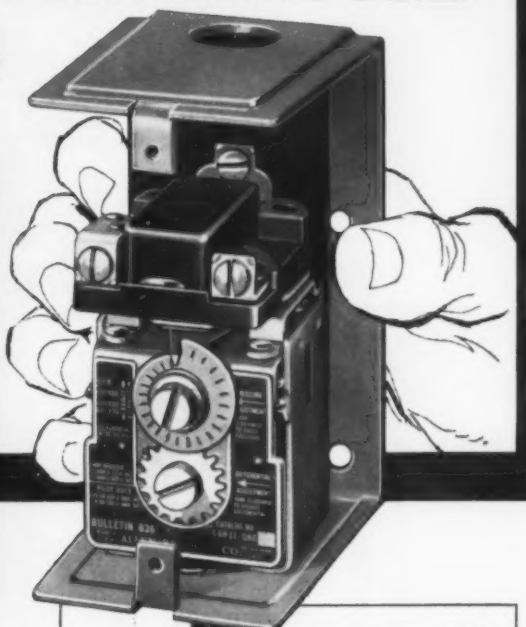
Ingersoll-Rand

9-891A **Merchandising Division, 11 Broadway, New York 4, N. Y.**

NEW

Allen-Bradley Air Conditioning and Refrigeration

PRESSURE and TEMPERATURE CONTROLS



A-B QUALITY

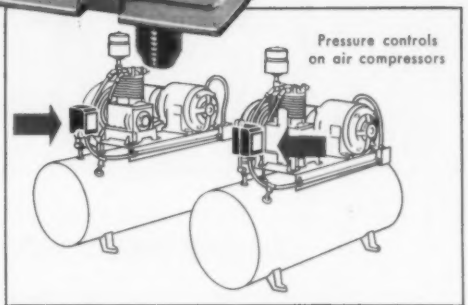
Longer Life
Lower Differentials
Attractive Appearance

Using an improved bellows design, these *new* A-B controls combine exceptionally low differentials with extremely long life — even when cycled from zero to maximum setting. Both the range and differential setting are easily adjustable —and a scale shows the operating point of the control.

The precision snap-action switch in these controls has no "dead center"—operation is absolutely positive. Vibration or mounting angle cannot cause faulty operation. And the pure silver contacts assure millions of trouble free operations—without maintenance.

For accurate and reliable control of pressure or temperature, you'll find nothing to equal these new controls—they're A-B *quality* throughout. Don't delay — write for details.

Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.



Pressure controls on air compressors

Bulletin 837 Temperature Control equipped with capillary tube and bulb.

Bulletin 836 Pressure Control for low pressures.

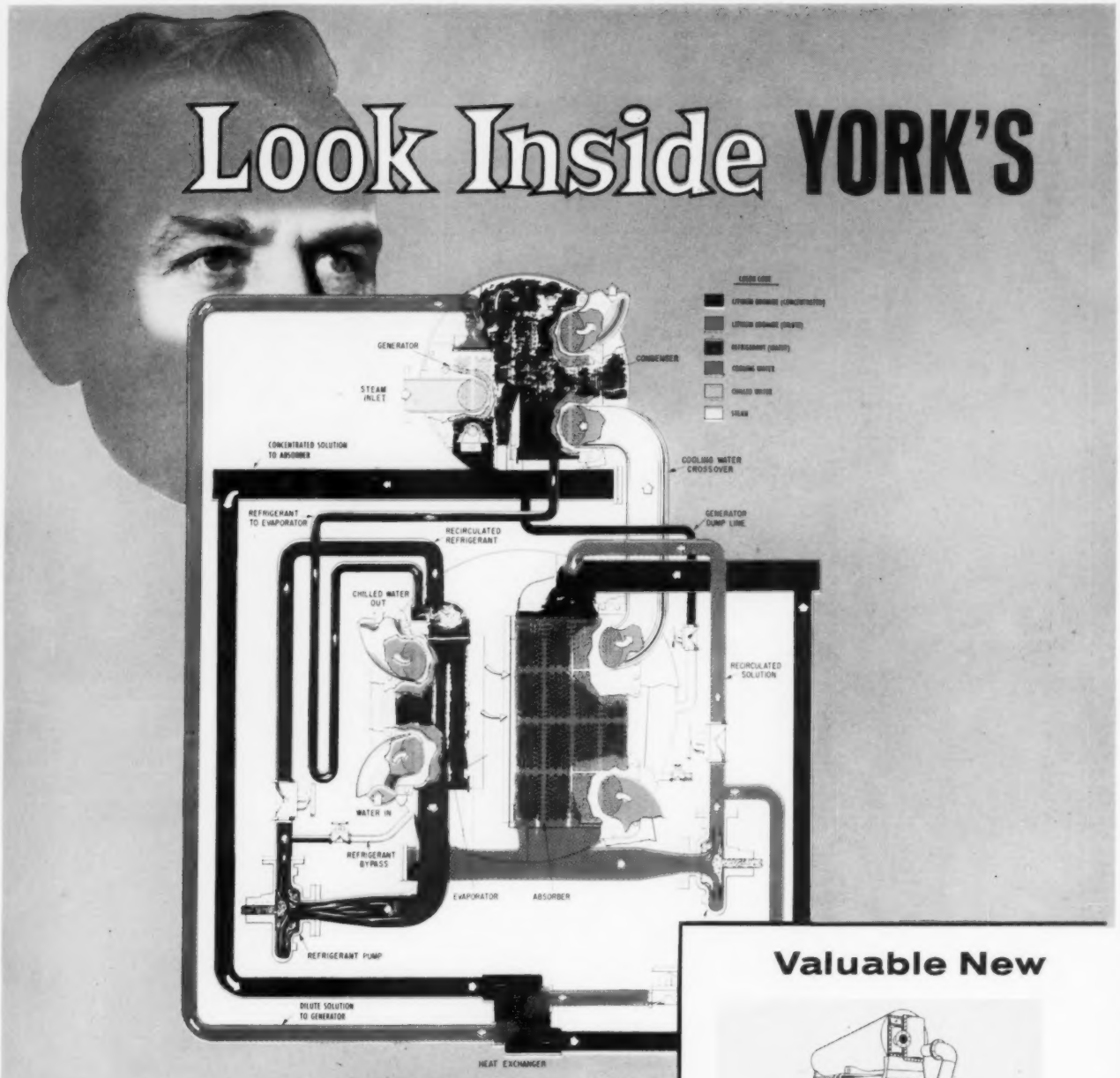
Bulletin 836 Pressure Control in NEMA Type 4 enclosure.

TEMPERATURE RANGES
From −150°F to 490°F

PRESSURE RANGES
From 30" vacuum (Hg) to 900° psi

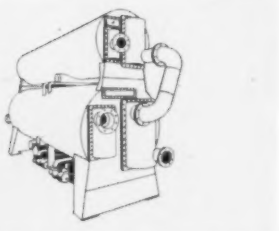
ALLEN-BRADLEY Quality Motor Control

Look Inside YORK'S



York Lithium Bromide System Cycle Diagram

Valuable New



LITHIUM BROMIDE Absorption Systems approach ideal absorption refrigeration cycle. Lithium bromide has low specific heat.

NEW LITHIUM BROMIDE SYSTEM

. . . See How 23 Years' Experience in Absorption Design Pays Off!

From York's background of 23 years' experience in absorption refrigeration comes the latest in automatic, heat-operated water-cooling systems. York's Lithium Bromide Absorption unit is ideal for air conditioning in areas where natural gas is inexpensive in relation to electricity or where steam is always available from power plants at such locations as hospitals, universities and institutions.

These heat-operated machines use low pressure steam or high temperature water as the activating medium. Plain water is the circulated refrigerant and lithium bromide, a simple salt, is the absorbent.

These non-toxic and non-explosive fluids need no replacement once the unit has been properly charged and balanced.

Flexible operation is assured under all load conditions by the very nature of the absorption cycle itself. Sudden load changes—from overload down to zero capacity—are easily accommodated.

Minimum maintenance becomes a reality with this new York Lithium Bromide Absorption Unit. Three small pumps and motors are the only moving parts of the entire system.

Ease of location in basements, upper floors or roofs without special sound or vibration precautions gives extensive savings in piping and pipe shafts.

Exclusive with York Lithium Bromide Absorption machines are these benefits:

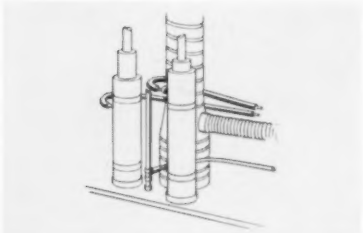
1. Advanced design generator which results in quiet operation—noisy teakettle effect is cut.

2. Low pump horsepowers which add up to significant operating economies.

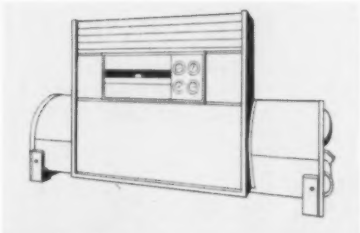
3. Elimination of special controls for condensing water from towers or well.

For Complete Details on this new system from York, call your nearest York Sales Office or write York Corporation, York, Pa.

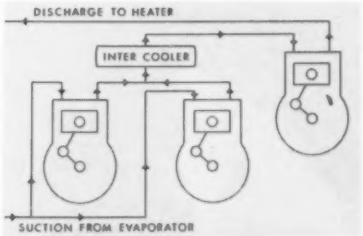
Products From York Borg-Warner Engineering!



3 PIPE HI-I Induction Systems cut primary air needs up to 30% and require no air or water zoning. Tenants can change temperature easily.



TURBOPAK Water Chiller is factory assembled and sound conditioned. Takes 50% less space. Needs no on-the-job refrigeration piping.



HEAT PUMPS with compound compression are *practical* and economical even in severe below 0° weather. Can be factory assembled.

YORK

YORK CORP. SUBSIDIARY OF BORG-WARNER CORP.

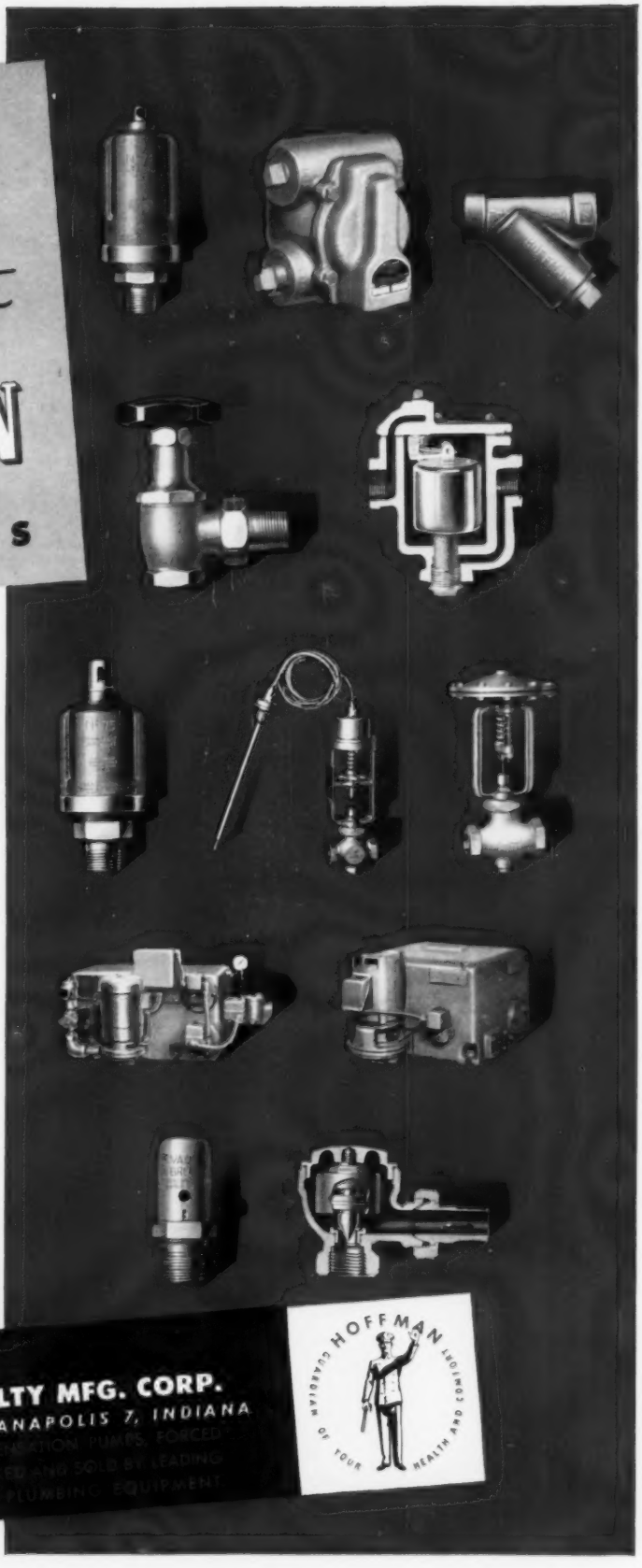
BORG-WARNER
RESEARCH AND ENGINEERING
MAKE IT BETTER

Air Conditioning, Heating, Refrigeration and Ice Making Equipment • Products for Home, Commercial and Industrial Installations

...for better control of every steam system requirement

HOFFMAN

STEAM SPECIALTIES



Each Hoffman product is distinguished by exclusive features that assure customer satisfaction—long carefree service. For either one-pipe or two-pipe residential or industrial systems there's a Hoffman Trap, Valve, Pump or other specialty designed to give you better control of every requirement. This complete, tested quality line is backed by a dependable, single source of supply and responsibility. Write for complete catalog.

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HOFFMAN GUARDIAN OF YOUR HEALTH AND COMFORT

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• No matter what size the wheel—it must balance electronically before it is installed in its scroll. Permanent corrections are made at this spot to insure perfect balance. Peerless Electric wheel balancing equipment is capable of handling the largest blower wheels made.

FAN AND BLOWER DIVISION

THE *Peerless-Electric*® COMPANY

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WARREN, OHIO

Member of the Air Moving and Conditioning Association, Inc. (AMCA)

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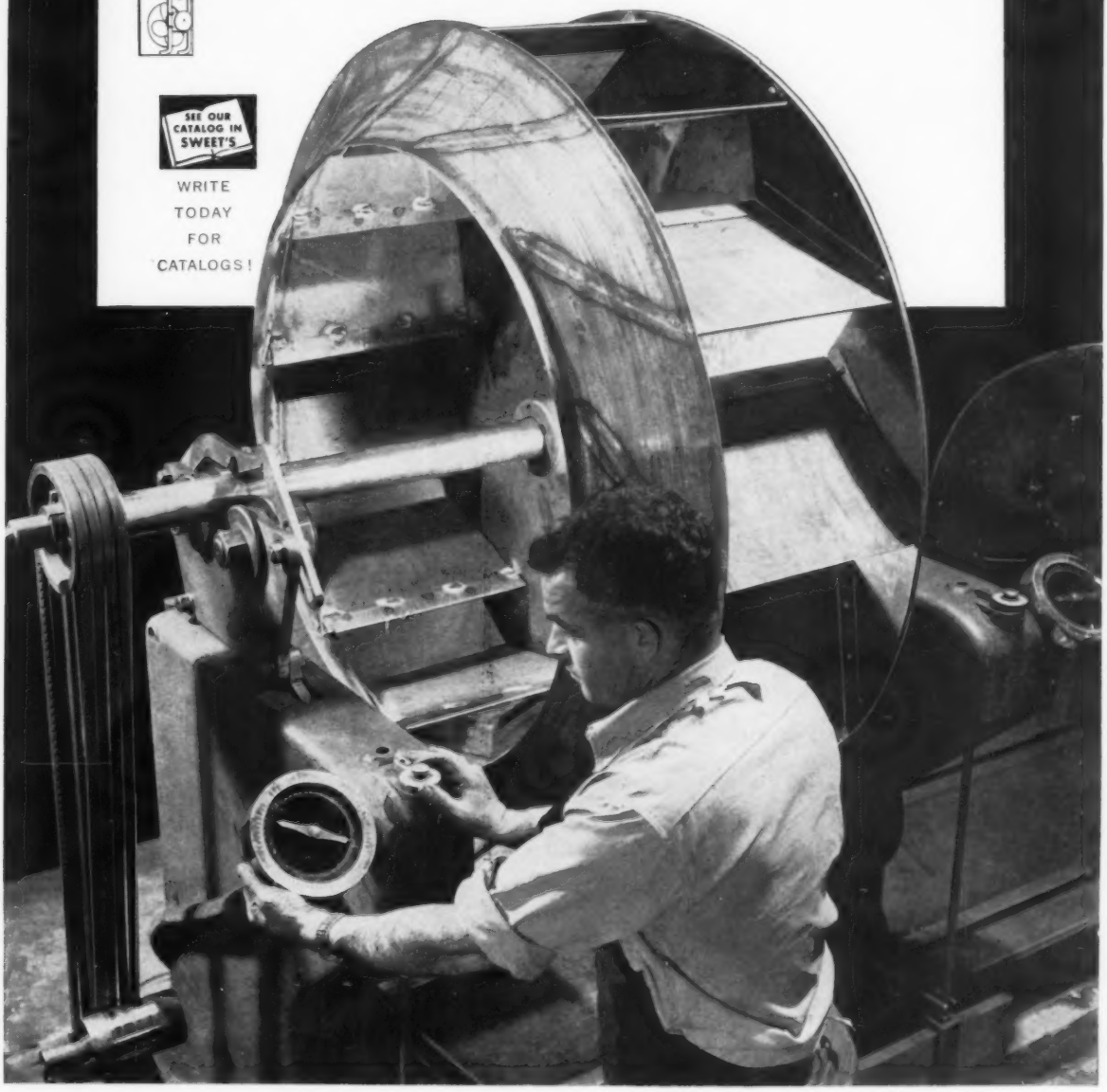
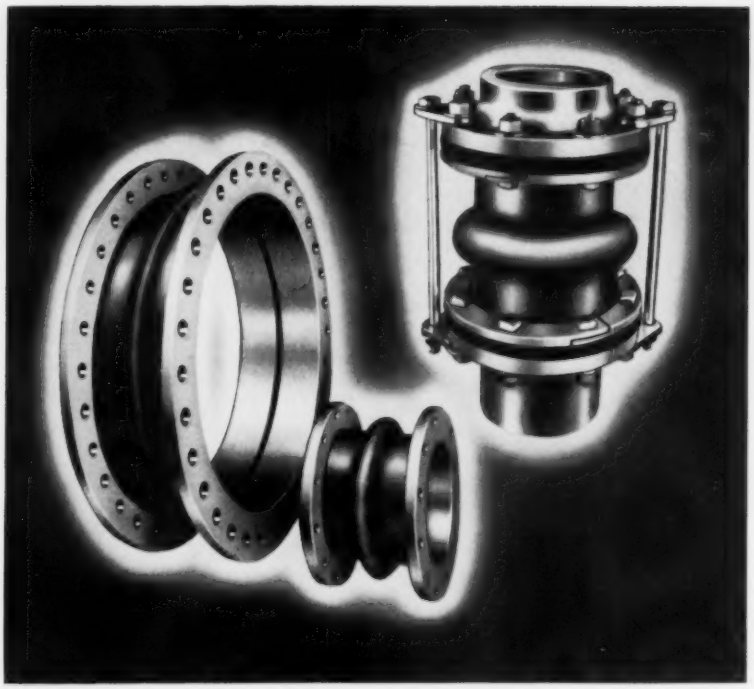
WRITE TODAY FOR CATALOGS!



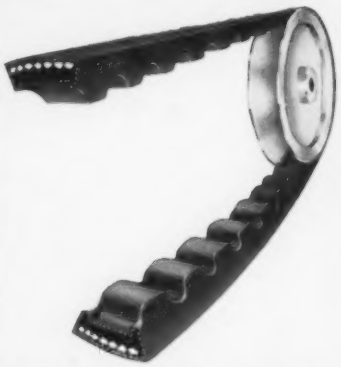


R/M Rubber Expansion Joints and Pipe Solve Piping Stress and Vibration Problems

Repeated flexing caused by changes in temperature can put dangerous strain on pipe, fittings and associated equipment used in modern ventilating and air conditioning systems. R/M Rubber Expansion Joints *absorb* this movement . . . prevent stress caused by expansion and contraction . . . eliminate costly maintenance problems inherent with conventional pipe joints. At the same time they *insulate* system pumps, blowers, compressors and similar equipment against transmission of destructive vibration and noise. Rubber joints also avoid misalignment where space is limited . . . or where equipment may be operating above rated capacity.

On pipe lines subject to noise, vibration and electrolysis, Condor Flexible Rubber Pipe outlasts iron or steel . . . permits easy installation that eliminates pipe joint leakage.

You get more dependability and economy with Manhattan Rubber Expansion Joints and Condor Flexible Rubber Pipe than possible with other methods . . . "More Use per Dollar" in handling water, steam, other fluids and gases. Let an R/M representative demonstrate these engineered advantages for your heating, cooling or other application. Write for Bulletin M685.



NEW R/M CX V-BELT*

- EXTREMELY QUIET . . . VIBRATION-FREE
- ONLY FULLY-MOLDED, FULLY-JACKETED LUGGED V-BELT
- FOR SMALL PULLEYS
- FLEXIBLE, STRONG, RUGGED
- OUTLASTS OTHERS UP TO 8 TO 1
- NO FLEX-CRACKING
- HOLDS SHAPE AND EFFECTIVE LENGTH WITHOUT STRETCH

*Made for original equipment. Patented.

CONDOR V-BELTS

For heavy industrial multiple belt units

- PRECISION MADE
- SMOOTHEST RUNNING V-BELTS MADE
- MORE GRIP, LESS SLIP
- LONGER, TROUBLE-FREE SERVICE
- LOWER DRIVE COSTS

R/M POLY-V® DRIVE

Single, Parallel V-Ribbed Belt

- MORE POWER — LESS SPACE
- CONSTANT SPEED RATIO
- ELIMINATES MULTIPLE V-BELT "MATCHING" PROBLEMS
- LESS BELT AND SHEAVE WEAR
- LESS INVENTORY (2 cross sections instead of 5)

"More Use per Dollar"

WRITE FOR DESCRIPTIVE BULLETINS

®Poly-V is a registered Raybestos-Manhattan trademark. Patented.

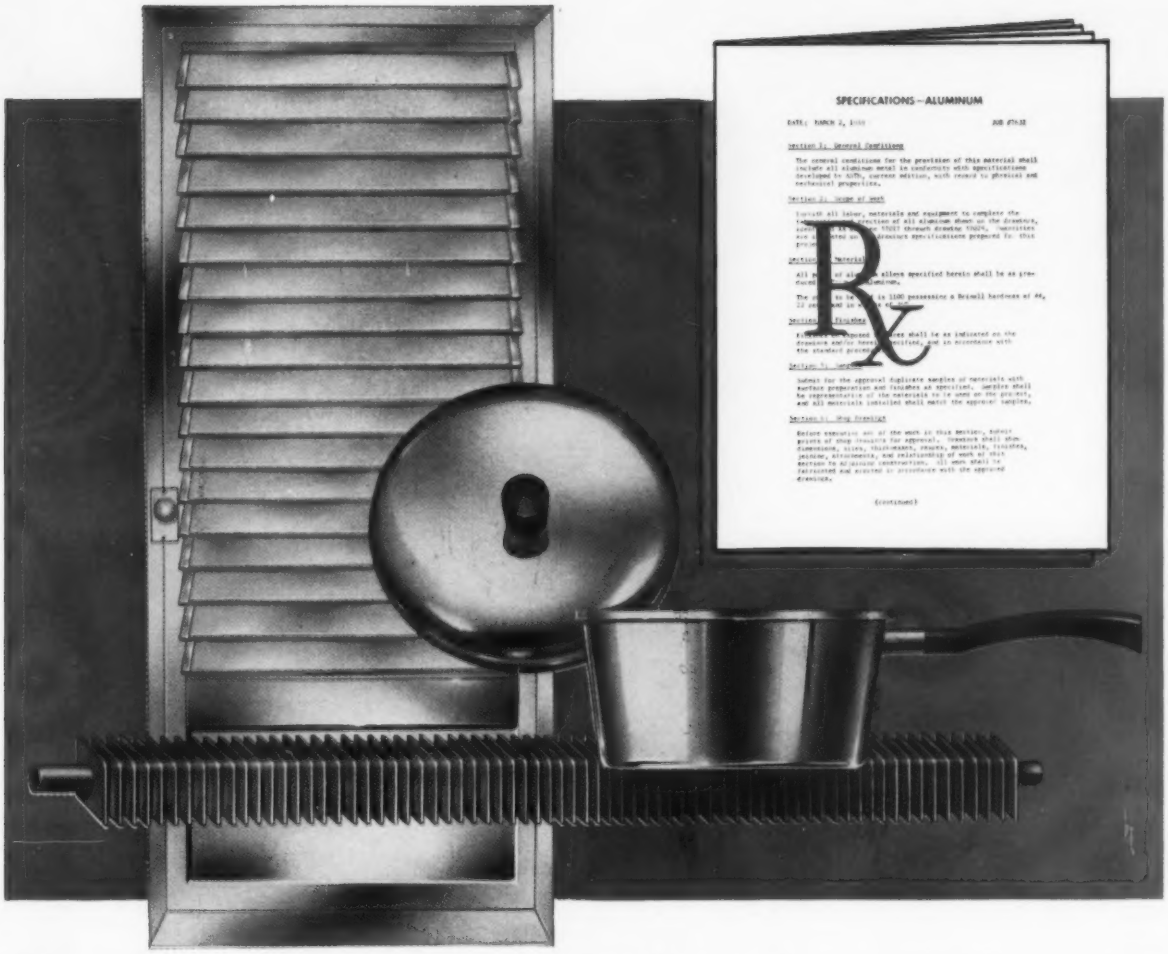
RM 938

BELTS • HOSE • ROLL COVERINGS • TANK LININGS • INDUSTRIAL RUBBER SPECIALTIES

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products: Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls



Aluminum by Prescription from Fairmont

When you specify Fairmont for your aluminum requirements, we like to go one step beyond your formal specification data. Whenever possible, we want to know all about the exact product you will be fabricating.

At Fairmont, we stand ready to meet all the standards you specify, but we like to add the benefits of our 32 years of experience in supplying aluminum for such diversified products as saucepans and awnings, bottle caps and chemical equipment, storm doors and fan blades, TV cabinets, name plates and cooling coils.

Be sure the aluminum you buy is the best for your product. Let Fairmont Aluminum *prescribe* the next lot of aluminum for you. You'll find it will be "Very truly yours."

For a free copy of Fairmont's latest technical bulletin, write or call today.

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Subsidiary of Cerro de Pasco Corporation

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Youngstown steel pipe

will serve the futuristic structures of his day

Tomorrow's imposing, functionally-designed office buildings, hotels, schools and apartments—the structures of *his* day—will make daily living an undreamed of pleasure . . . quite different from that of Dad's time. Youngstown is anticipating tomorrow's need for bigger and better pipe. Our metallurgical research and expanding production facilities will make certain that when tomorrow's construction engineers call for better steel pipe . . . *Youngstown will supply it in quantity.*

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YOUNGSTOWN
SHEET AND TUBE COMPANY
Youngstown, Ohio

Manufacturers of Carbon, Alloy and Yoloy Steel

new versatility

with the new

Nesbitt SERIES A

CABINET HEATERS

27 STANDARD FLOOR TYPE INSTALLATIONS

plus

32 STANDARD WALL AND CEILING TYPE INSTALLATIONS

equals

59* STANDARD INSTALLATION ARRANGEMENTS

multiplied by

7 STANDARD MODELS

totals

413

STANDARD MODEL INSTALLATION ARRANGEMENTS!

* 34 of these arrangements can be inverted. All are available with a variety of motor speeds and (steam or water) capacities.

You can fit these compact, quiet, trouble-free units easily and smartly into any plan. They're available in seven standard colors, with baked enamel finish. Get all the facts. Write Nesbitt for publication 403-2.

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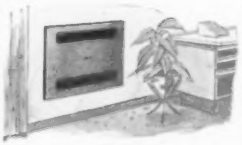
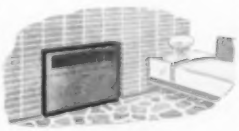
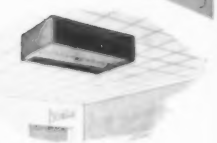


offices

lobbies



institutions



business places

Write for data, too, on the new Nesbitt ROOMMATE year-round cabinet air conditioner.

Nesbitt

HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

Made and sold by John J. Nesbitt, Inc., Philadelphia 36, Pa.

"QUALITY and ECONOMY... SPANG Steel Pipe gave us both"

says Mr. Joseph Yanasheski, Piping Estimator for Joseph A. Rado, Mechanical Contractor, Berwick, Pa.

"One of the biggest problems in our business is to do a first-rate job and still keep costs in line," states Mr. Yanasheski. "With the help of SPANG CW Steel Pipe we were able to do just that at the Berwick, Pennsylvania, Hospital installation. Not only did SPANG Steel Pipe assure us of a reliable performance, but also the economy of using steel pipe helped us keep costs down.

"Another advantage to using SPANG Steel Pipe is its good welding qualities. By welding instead of threading the pipe, we achieved a considerable savings in time costs and eliminated the danger of leakage at the joints."

KEEP YOUR INSTALLATION COSTS DOWN, TOO... WITH SPANG CW STEEL PIPE

When you use SPANG CW Steel Pipe you get *top-quality*, money-saving performance. Why? Because SPANG Pipe is *quality-controlled* during manufacturing and thoroughly tested before shipping. Your SPANG Distributor can give you the fast, efficient service you require. Next job, make it steel pipe . . . make it SPANG.

SPANG CW STEEL PIPE

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

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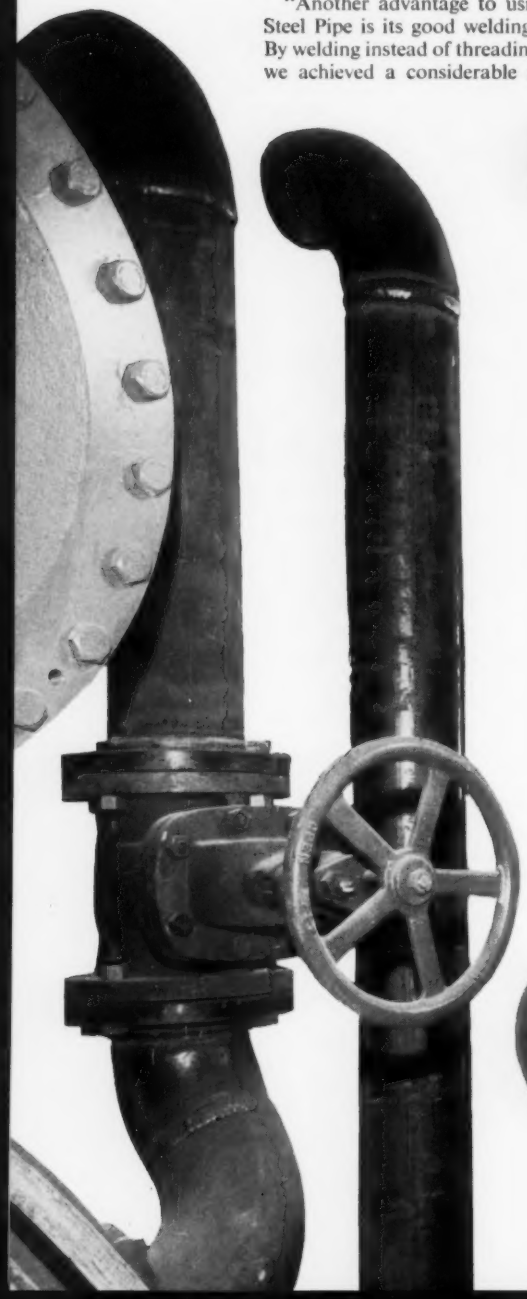
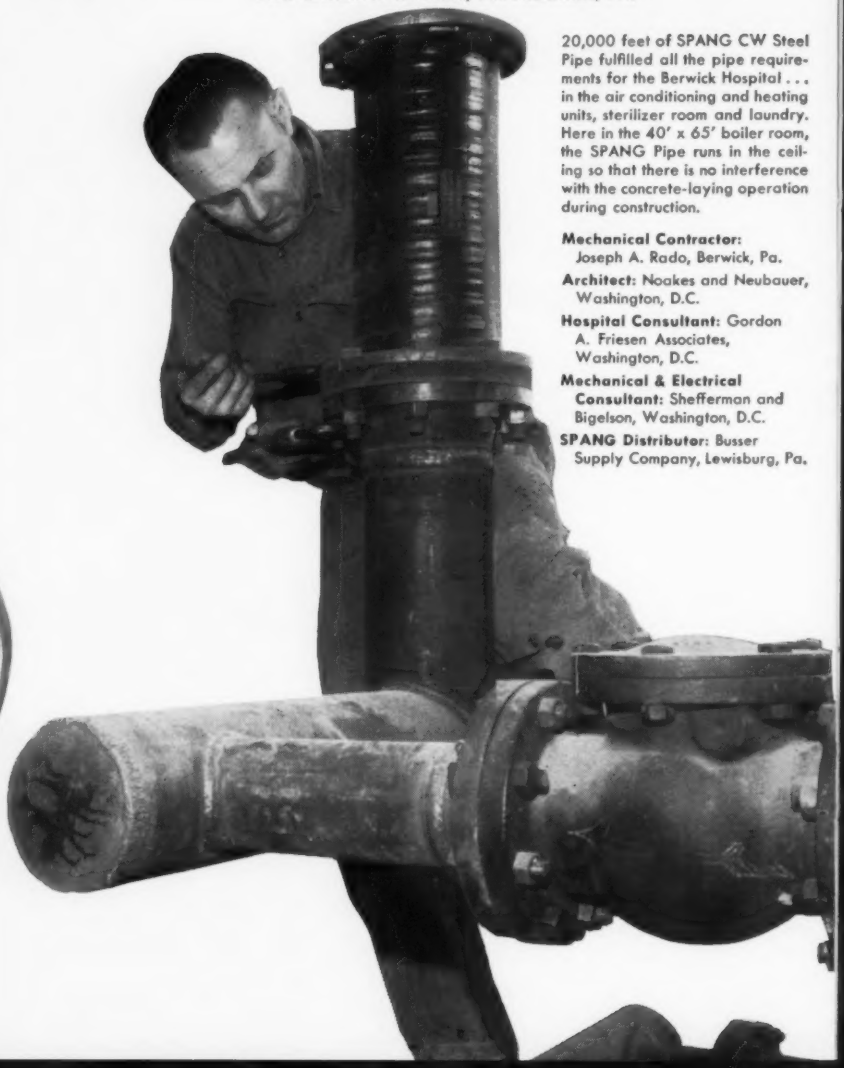




20,000 feet of SPANG CW Steel Pipe fulfilled all the pipe requirements for the Berwick Hospital . . . in the air conditioning and heating units, sterilizer room and laundry. Here in the 40' x 65' boiler room, the SPANG Pipe runs in the ceiling so that there is no interference with the concrete-laying operation during construction.

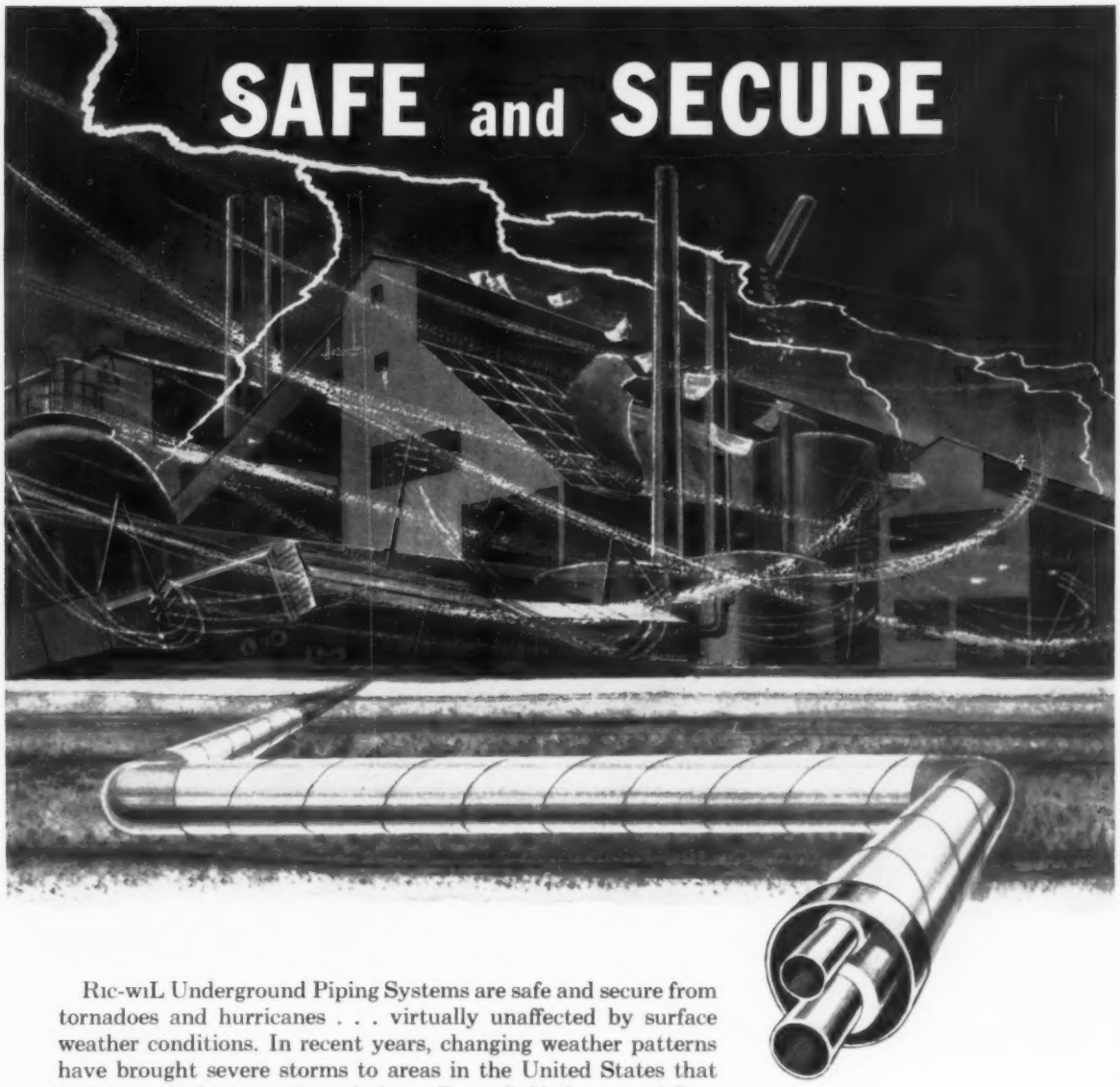
Mechanical Contractor: Joseph A. Rado, Berwick, Pa.

Architect: Noakes and Neubauer, Washington, D.C.

Hospital Consultant: Gordon A. Friesen Associates, Washington, D.C.

Mechanical & Electrical Consultant: Shefferman and Bigelson, Washington, D.C.

SPANG Distributor: Busser Supply Company, Lewisburg, Pa.



Ric-wiL Underground Piping Systems are safe and secure from tornadoes and hurricanes . . . virtually unaffected by surface weather conditions. In recent years, changing weather patterns have brought severe storms to areas in the United States that had never before experienced them. Ric-wiL Underground Systems remained unharmed . . . and in an emergency situation, immediate heat can be an important factor in restoring operations as quickly as possible.

Ric-wiL Systems have been proven by installations totaling more than 8,000,000 lineal feet. They are completely prefabricated and shipped to the job sight ready for installation. Production time and delivery can be definitely predetermined.

Write, wire or phone for information on the many types of Ric-wiL Systems available.

Send for new revised catalog.

Quality Piping Systems . . .
. . . of Exceptionally High Thermal Efficiency

SINCE 1910

RIC-WIL INCORPORATED — PREFABRICATED INSULATED PIPING SYSTEMS

BARBERTON, OHIO

IN CANADA: THE RIC-WIL COMPANY OF CANADA LIMITED

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Introducing the all new **"FIBER-AIRE"** by **Swartwout**

All Fiberglas* Housing
Super Quiet
Indestructible
High Efficiency

- Fiber-Aire's all Fiberglas* housing actually **absorbs** noise and vibration . . . sets a new standard for ventilator quietness.
- Bonded Fiberglas* housing is virtually impossible to dent, crack or break . . . unaffected by salt spray, weather, fumes and most chemicals.
- Low contour and molded-in sky blue color enhance building design . . . Fiber-Aire never needs painting.
- Stainless steel air flow guides eliminate internal air shocks . . . increase efficiency . . . cut vibration.
- High efficiency throat and outlet minimize loss from friction and turbulence.

Fiber-Aire units are now available for immediate delivery in 21 direct and belt drive models with capacities from 180 to 4,000 CFM.

You'll get the complete story on the fabulous new Fiber-Aire ventilators in Swartwout's free bulletin "FA-1". Write now.

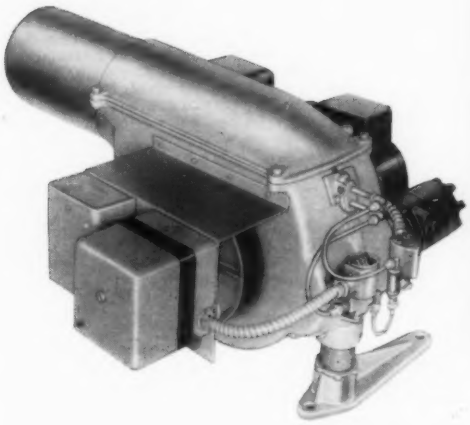
The Swartwout Co.
Ventilation Engineering
18568 Euclid Avenue — Cleveland 12, Ohio

* TM Owens Corning Fiberglas Corporation

In Canada: Eastern Steel Products Ltd., 8 Bermondsey Road, Toronto, Ontario

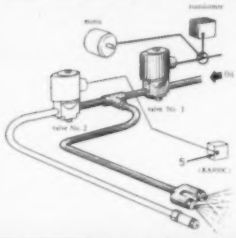
2 NEW ACCESSORIES

for high input oil burners



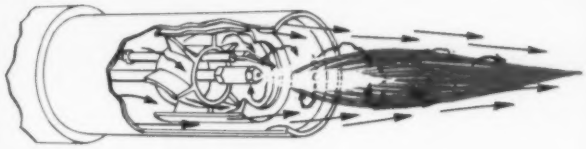
D-LAY-FLO*... insures smooth, quiet starts even at 40 g.p.h.

D-Lay-Flo, optional on Nu-Way burners firing 6 to 40 g.p.h., effectively prevents the "hard starts" occasionally experienced with large inputs of light oil. Valve #2 holds back one-third of oil capacity approximately 15 seconds . . . time for flame and flue gas travel to be established. Result: quiet starts. Then valve #2 opens, automatically giving full capacity. Nu-Way's carefully designed D-Lay-Flo air handling parts makes air modulation unnecessary. Only familiar, time-tested components are used in this assembly . . . greatly simplifying installation and service.



*TM

Narrow flame... for narrow or limited combustion areas



Nu-Way burners with Narrow Flame are truly the answer for direct fired furnaces and Scotch marine boilers . . . in fact for any application that needs a long, narrow flame. Thanks to tube-within-a-tube construction, a wall of higher velocity secondary air at the circumference molds the flame to a long, slim shape. Insures stable flame bases . . . most efficient combustion. Here's a unique accessory that will prove a must in many cases.

For descriptive literature, write Dept. HP-459.

THE Nu-Way CORPORATION

Heating Equipment Rock Island, Illinois

ALSO ASK US ABOUT Sundstrand ALL-ELECTRIC BURNERS

for complete... sure... permanent... low cost

UNDERGROUND HOT PIPE PROTECTION

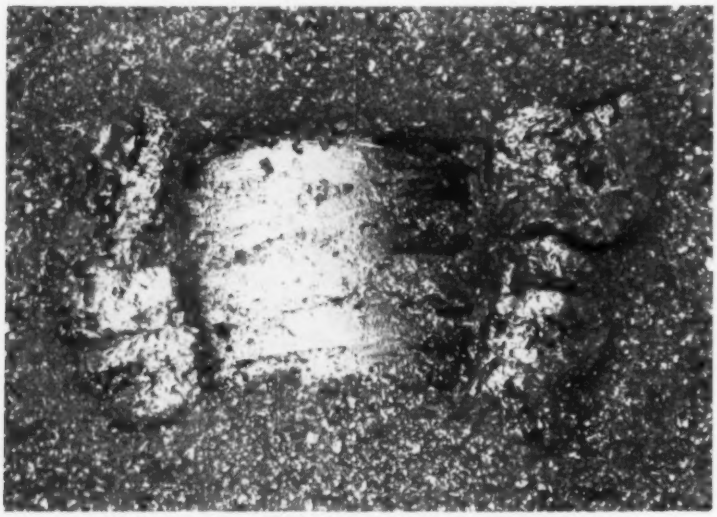
Specify and Use.....

TRI-SUL-ITE

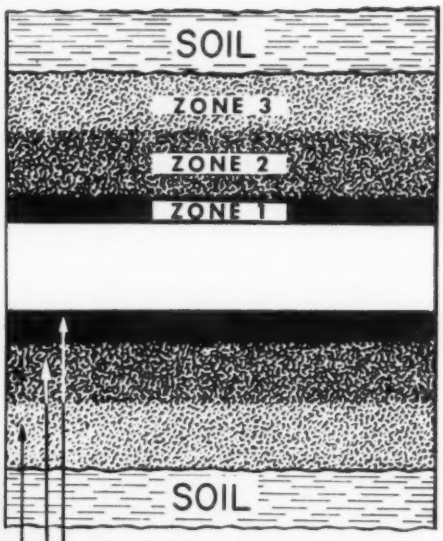
3-WAY PROTECTION SYSTEM *

THE ZIEGLER GILSONITE MINERAL

Looking for an underground piping system that's free from excessive heat loss... yet gives the greatest protection possible from corrosive soil conditions? A system with a low installation cost and minimum maintenance expense? Then TRI-SUL-ITE 3-way protection system is your answer. TRI-SUL-ITE installations have proven to be the speediest... easiest... surest underground pipe protection. TRI-SUL-ITE, a specially selected gilsonite, is poured under and around all pipes in the trench. After proper curing, it forms three zones of protection against water, corrosion and heat loss.



Close-up photo illustrates the plastic zone of TRI-SUL-ITE peeled back to show excellent adhesion for pipe protection.



*** ZONE 1 PROTECTION: PERMANENT WATER BARRIER**

The first zone of TRI-SUL-ITE adjacent to the pipe, fuses from pipe heat into an impermeable, waterproof coating. It resists normal soil acids and alkalis. When it is plastic the pipe movement is contained within this zone. The first zone of TRI-SUL-ITE protection gives positive assurance that water cannot follow the grade of the pipe.

*** ZONE 2 PROTECTION: EXCELLENT INSULATOR**

The second zone consists of the edges of the TRI-SUL-ITE granules fused to isolate the air spaces, resulting in a highly effective insulator which minimizes heat losses to the soil.

*** ZONE 3 PROTECTION: INSULATOR AND WATER BARRIER**

The third zone of TRI-SUL-ITE granules is not fused by heat and provides maxium insulating efficiency plus good resistance to water penetration and protection against surface shocks and subsoil stresses.

Write for complete literature.

ZCO

G. S. ZIEGLER & COMPANY

GREAT NECK, N. Y.

Agents in Principal Cities Throughout the United States and Canada.

MINES: "CASTLE PEAK," "LITTLE BONANZA," "LITTLE EMMA."

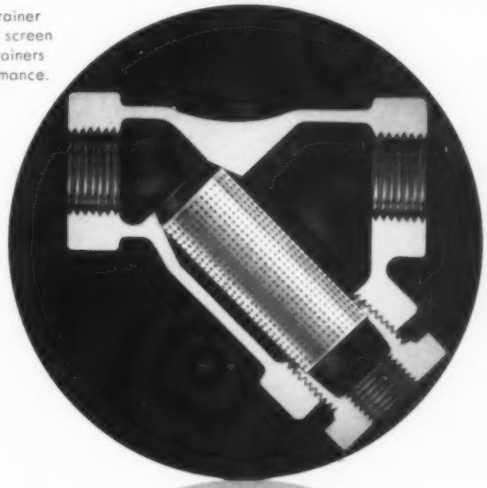
protect your equipment against scale and dirt

Exterior view of NEW Sarco Type "AT" Pipe Line Strainer. Note 45° blow-down angle to facilitate piping away from strainer.

with this

NEW SARCO TYPE "AT" PIPE LINE STRAINER

Cutaway of NEW Sarco Type "AT" Strainer shows sediment collection chamber below screen. Standard screen used in Sarco "AT" Strainers is key to their uniformly successful performance.



Examine one of the new Sarco Type "AT" Strainers and you'll notice at once that its design is a marked improvement over that of contemporary strainers . . . in three important ways:

The Sarco screen, key element of the unit, fits tightly into a long, tapered screen seat. This feature absolutely stops the by-passing of particles around the screen. Secondly, the rigid, welded construction of heavy-gauge brass makes sure the fit will remain tight, even when trapped sediment builds up pressure.

Third, you'll see that the new AT is easy to clean. No sharp edges or weave crevices in the screen for particles to cling to. Blow-down cleaning is simplified by the 45° angle construction.

Write for Sarco Bulletin No. 1210B which gives dimensions, capacities, and technical data. 7317-B

NOTE THIS ADDED PROTECTION AND CONVENIENCE

1. Bodies of heavy-duty 250 psi semi-steel. Tensile strength to 30,000 # per square inch minimum.
2. For maximum strength, bodies are reinforced with external rib.
3. Long, tapered screen seat assures correct screen position and tight fit without buckling.
4. Cap design provides a sediment collection chamber below screen.
5. Generous proportion of open screen area in relation to pipe size minimizes pressure drop.

SARCO
COMPANY, INC.
635 Madison Avenue, New York 22, N. Y.

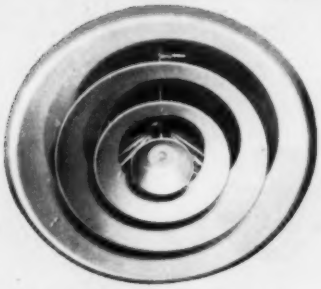
STRAINERS • STEAM TRAPS • TEMPERATURE CONTROLLERS • HEATING SPECIALTIES

ANEMOSTAT®

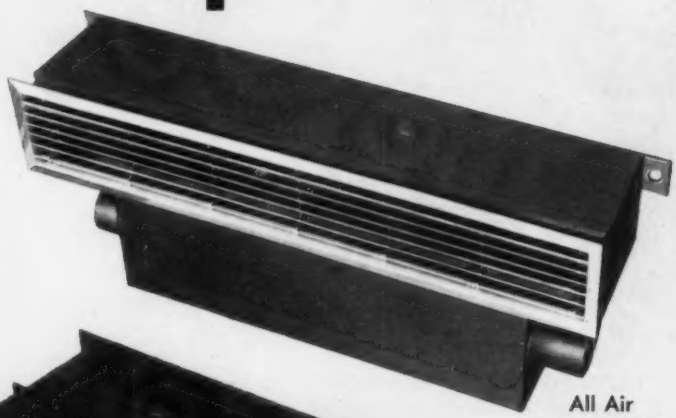
is a registered trademark for a wide range of air diffusion equipment

Today Anemostat offers an impressive variety of air diffusion equipment to meet every architectural and engineering requirement. ANEMOSTAT® is a registered trademark. It is your guarantee that every unit bearing this name is of highest quality . . . backed by the most experienced engineering, research and testing laboratories in the industry.

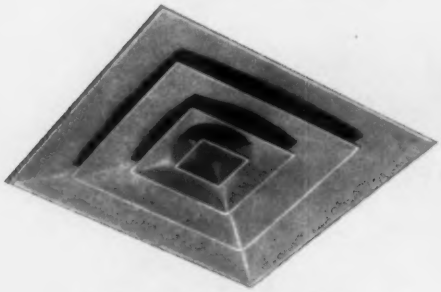
When Anemostat Air Diffusers are in sight the system is right. This was true yesterday, is true today and will be true tomorrow.



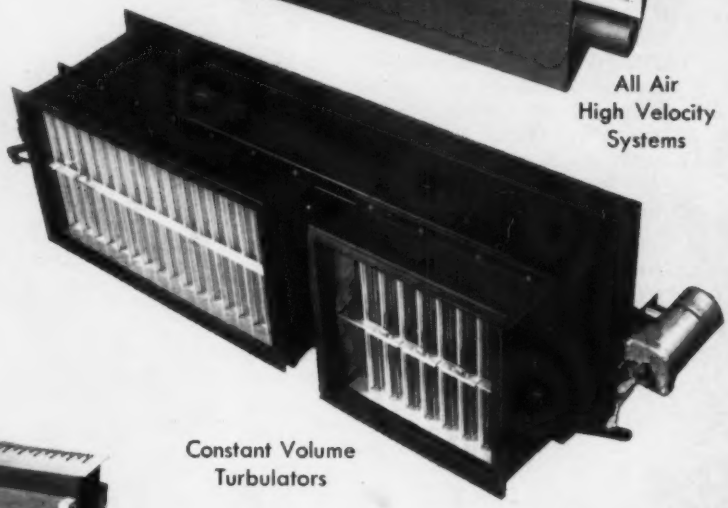
Conventional Air Diffusers



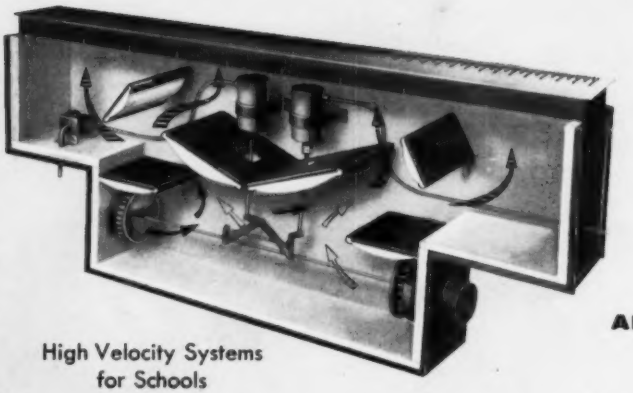
All Air High Velocity Systems



100% Induction Air Diffusers



Constant Volume Turbulators



High Velocity Systems for Schools

ANEMOSTAT®

ANEMOSTAT CORPORATION OF AMERICA

10 EAST 39th STREET, NEW YORK 16, N. Y.

Representatives in principal cities

"No Air Conditioning System Is Better Than Its Air Distribution"

In super-motels, "super 8's" and supermarkets...

Air-conditioned luxury is only a few feet from your car in today's super-motels. For travellers, air-conditioned super-motels like the one shown above are a home away from home—combining convenience, comfort, often such added attractions as air-conditioned lounges, playrooms and restaurants. Motels *without* air-conditioning just can't compete.

The men enjoy smoking cigars and, with air-conditioning in the car, the whole family enjoys the trip—with the windows up! Americans spent about $150,000,000 on automobile cooling equipment in 1958.

Shopping convenience and comfort—in one of the thousands of bright new air-conditioned supermarkets that make shopping so pleasant. Smart store operators know that air-conditioning increases sales volume.

You'll find

genetron®

SUPER-DRY REFRIGERANTS

Approved!
Accepted!
Preferred!

"Genetron" super-dry refrigerants are universally accepted for use as original or replacement charge in America's finest refrigeration and air-conditioning equipment. Leading manufacturers approve and endorse them. Refrigeration engineers specify them. Wholesalers recommend them. Servicemen and contractors know they can depend on them. That's because "Genetrons" offer unexcelled quality and dryness . . . and their strict specifications are consistently *bettered* in production.

"Genetrons" are available from wholesalers everywhere, coast to coast. See your wholesaler! Insist on "Genetron"!

genetron 11 ORANGE LABEL CCl_3F
TRICHLOROMONOFLUOROMETHANE

genetron 12 WHITE LABEL CCl_2F_2
DICHLORODIFLUOROMETHANE

genetron 22 GREEN LABEL $CHClF_2$
MONOCHLORODIFLUOROMETHANE

genetron 113 PURPLE LABEL $C_2Cl_3F_3$
TRICHLOROTRIFLUOROETHANE

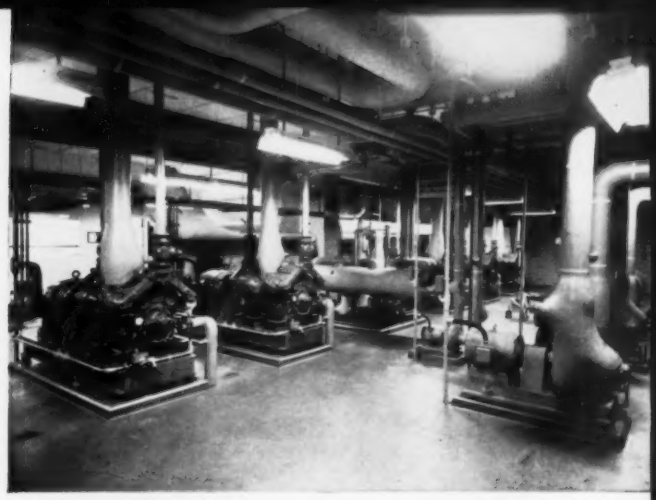
genetron 114a BLUE LABEL $C_2Cl_2F_4$
DICHLOROTETRAFLUOROETHANE

GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N.Y.

Allied Chemical

cold weather air heats new 9 story building

World's largest electric air source heat pump installation uses 12 Weinman pumps



MAIN BATTERY. The main heat pump for the Columbus and Southern Ohio Electric Co. consists of 2 separate systems, each having three 100 hp. compressors (a total of 6). Right foreground: Weinman pumps in water distribution system are insulated to keep condensate off floor.

NEW Columbus and Southern Ohio Electric Co. building, Columbus, Ohio has 9 stories above ground, one floor below ground level. It is designed for ultimate occupancy by 1,000 persons.

The world's largest electrically powered air source heat pump air-conditions this new building with 171,200 sq. ft. of floor space. The heat pump supplies 3.5 million BTU per hour for winter heating and 700 tons of refrigeration for summer cooling. This is the first application of a heat pump with a high-velocity induction system. The primary air system supplies high-velocity air to 537 underwindow water coil units around the building perimeter. These induction units are supplied 52°F. water the year 'round. Water temperature for the air-handling system serving the interior core of the structure is maintained at 42°F.

Weinman pumps used exclusively

12 Weinman pumps handle all liquids circulated in this big system. This includes hot and chilled water distributed to the air-handling system and hot water supplied to coils which reheat filtered air. In addition, heated oil is piped under the sidewalks to melt snow and ice.

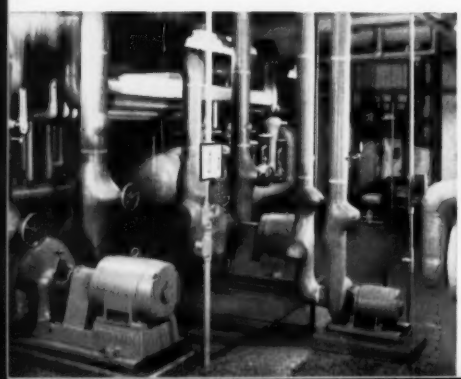
Only Weinman pumps are used in this big installation. No other make. There's a good reason. Weinman's complete line guarantees the right type, size and capacity pump for every need. And Weinman quality assures top efficiency, dependability and operating economy. Whatever your pumping problem, it will pay you to call your Weinman representative (he's in the Yellow Pages) or write us direct.

50th Anniversary 1909-1959

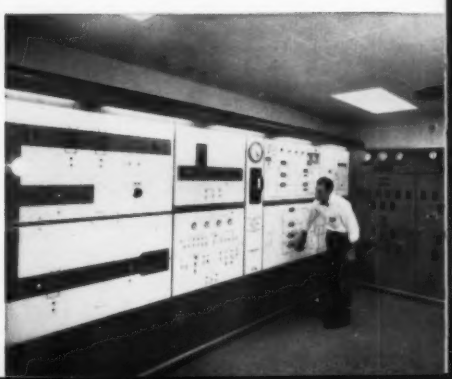
THE **WEINMAN PUMP** MFG. CO.

390 SPRUCE STREET COLUMBUS 8, OHIO

CENTRIFUGAL SPECIALISTS



NEAT ARRANGEMENT. Weinman Type L-1 pumps, at left, move hot and chilled water through air-handling distribution system. Smaller Type K Unipump (right foreground) pumps cooling water only to IBM room. Because of heat produced by this equipment, room must be cooled all 12 months of the year. Note: Plaque which describes color code used in the power room.



NERVE CENTER. Supervisory data center monitors and controls the entire air-conditioning system. Here, engineer senses return water temperature at one of 75 test points.

BRUNER Industrial WATER SOFTENERS

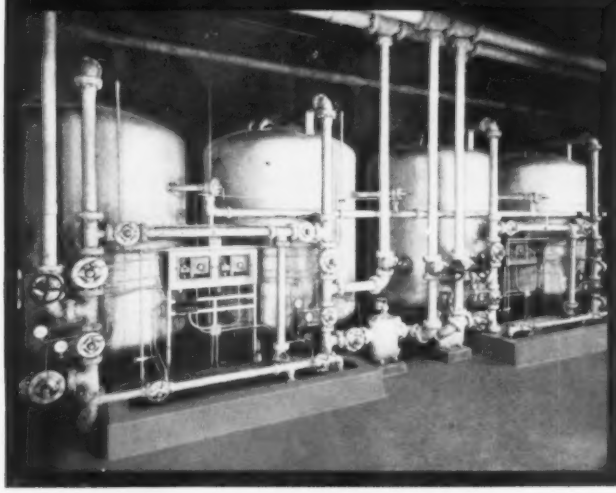
. . . are frequently

SPECIFIED

by leading engineers for important installations

This is Mayfair, Milwaukee, one of the largest shopping centers in America. One of Bruner's largest water softener installations softens all the water — even in the air conditioning system.

Hundreds of Bruner commercial and industrial installations throughout the United States and in many foreign countries are providing trouble-free service in both large and small applications. Water softeners, filters, and other Bruner water conditioning equipment are available for immediate delivery from stock in many types and sizes. Custom installations are fabricated to engineer's exact specifications.



The Bruner softeners at Mayfair are fully automatic. Salt storage and brining systems are specially designed. Softener capacity is 13,000,000 grains and delivers 1,750,000 gallons of softened water @ 1200 GPM.

Consulting Engineer: L. R. SCHMAUS CO., INC., Milwaukee, Wis.

Architect: GRASSOLD-JOHNSON & ASSOCIATES, Milwaukee, Wis.

Plumbing Contractor: SEDLET PLUMBING & HEATING, INC., Milwaukee, Wis.

Automatic Industrial type softener carried in stock.

BRUNER WATER SOFTENERS & FILTERS

BRUNER CORPORATION

America's most complete line of quality water softeners and filters.

Executive Offices: 4763 N. 32nd ST., MILWAUKEE 9, WIS.
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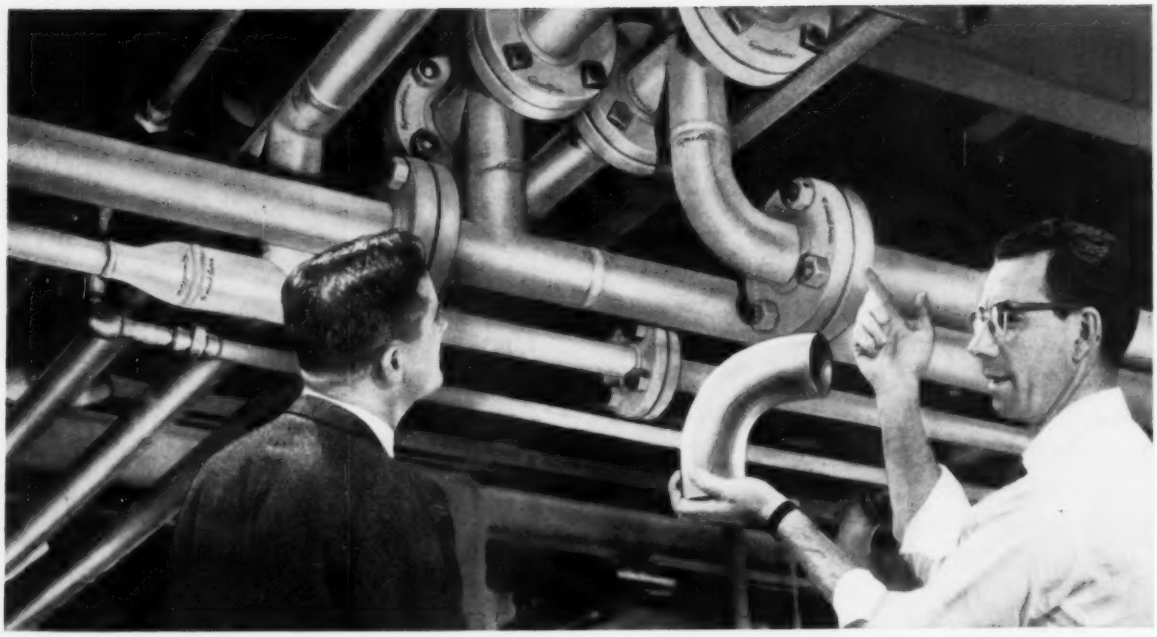
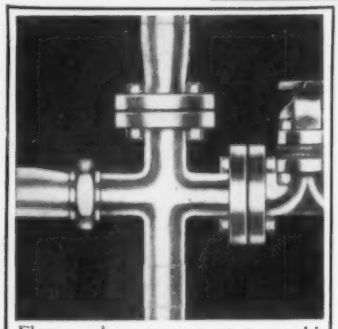
Plants: Milwaukee, Wis., and Los Angeles, Calif.
Sales and Engineering Offices in all principal cities.



SPEEDLINE'S EXTRA LENGTH FEATURE GAVE US MORE PIPE PER FITTING DOLLAR



Flange where you want to, weld where you want to . . . any type joint can be used with any Speedline fitting. The longer straight section provides ample clearance that simplifies installation and permits easier hook-up of valves, flanges, etc. even in confined areas. The extra length feature is common to all Speedline Ells, Tees, Crosses, Reducers and Bends.

SEE DISTRIBUTOR LISTING PAGE 593 IN CHEMICAL ENGINEERING CATALOG.

Extra length on *every* end of *every* Speedline corrosion resistant fitting adds up to *real* savings in pipe costs, compared to systems using conventional fittings (see table).

Time and labor costs are also reduced from preliminary design to finished installation. Design detailing is minimized because any type joint can be used on any—or *all*—ends of a Speedline fitting. Speedline's longer length gives more clearance for welding and faster, *easier* pipe aligning . . . permits flanging *without* welding by a simple rolling-in operation! And because Speedline fittings are specially designed for use with low cost, light wall stainless pipe, material costs are substantially lower from the start.

Specify Speedline for your process lines—first in the industry to offer *extra* length for *greater* economy. Write for *free* catalog.

SPEEDLINE'S EXTRA PIPE LENGTH BONUS

I.P.S. SIZE	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"
90° Elbow	2½"	3"	2¾"	2½"	2½"	3"	2½"	4"	4½"
45° Elbow	2½"	3"	2¾"	2½"	2½"	3"	2½"	4"	4½"
Tee	4⅛"	4½"	4⅛"	3¾"	3⅜"	4½"	4⅞"	4⅞"	4⅞"
Cross	5½"	6"	5½"	5"	4½"	6"	6½"	6½"	6½"

With 100-2" Speedline elbows you get 25' more pipe than with conventional fittings. How do these pipe savings add up for your requirements?

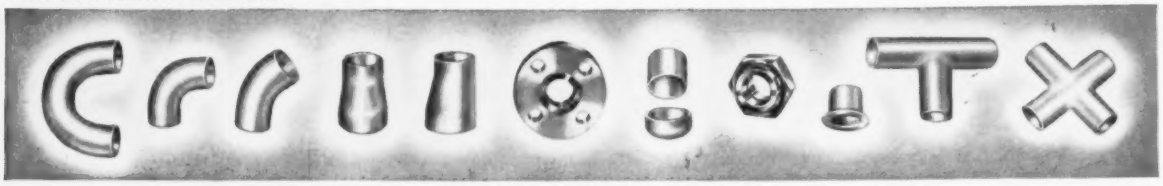
Speedline®

STAINLESS STEEL FITTINGS

SPECIALLY DESIGNED FOR SCHEDULES 5 AND 10 PIPE

® REG. T.M. OF HORACE T. POTTS COMPANY

901

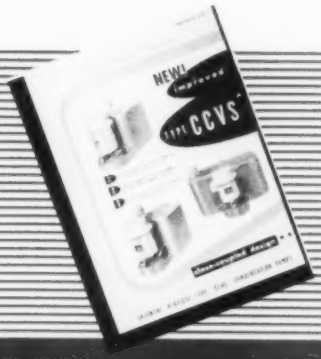


Manufactured by HORACE T. POTTS COMPANY • 576 E. Erie Ave., Philadelphia 34, Pa.

Skidmore Pumps

2 New Bulletins

MORE CAPACITY
MORE PERFORMANCE

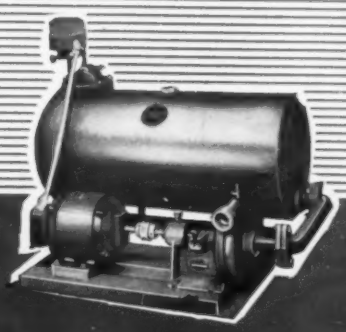


Send for Bulletin No. 21-C

The new SKIDMORE CCVS Vertical Pump features *close-coupled* design and *mechanical shaft-seal*. The single unit is built with 5, 10 and 20 gallon receivers. The duplex unit is designed with two float switches or automatic alternator. Capacities for the new CCVS Pump range from 500 to 10,000 sq. ft. E.D.R. Write for complete engineering data.

TYPE CCVS

Send for Bulletin No. 14-B



TYPE HS

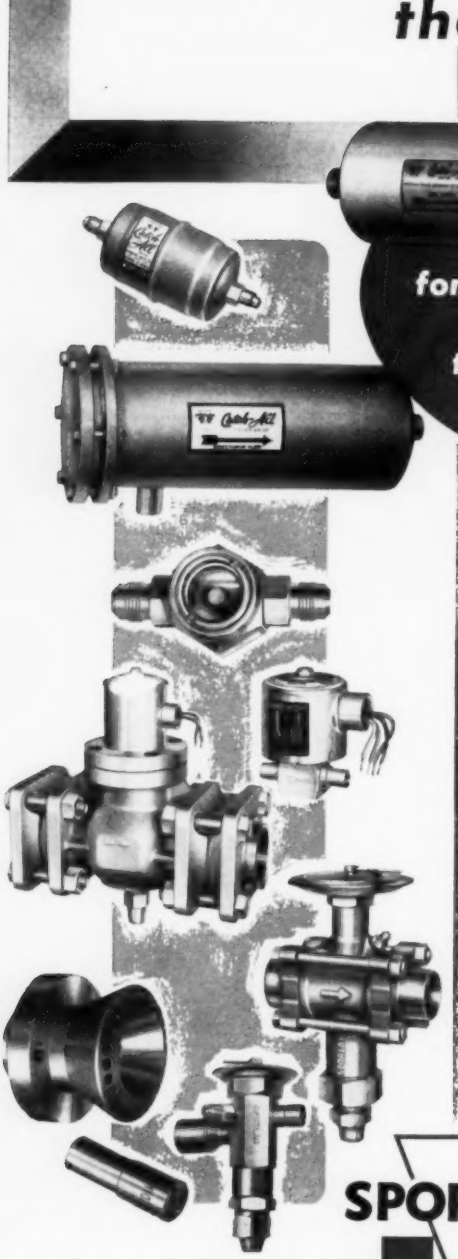
The economy HS Pump is especially well constructed with stainless steel shaft and bronze-fitted throughout. New capacities of the SKIDMORE HS Pump range from 1,000 to 125,000 sq. ft. E.D.R. with discharge pressures from 10 to 75 lbs. Pump is built in both single or duplex unit, and is mounted on steel base or cast iron if desired. Write for complete engineering data on this or other pumps.

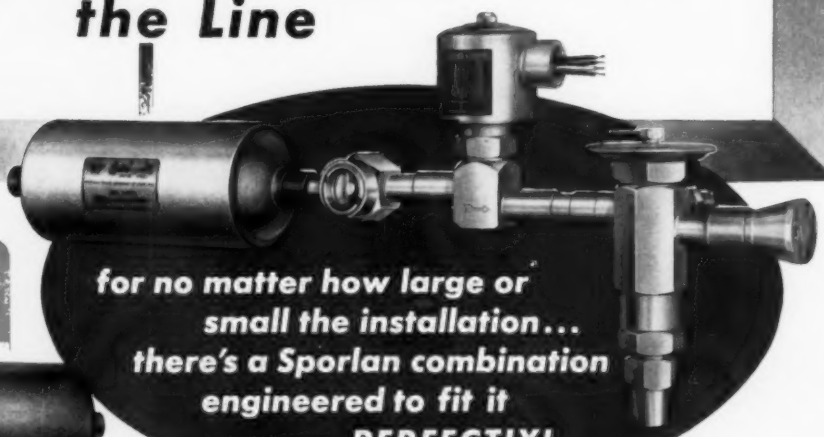
Since 1921

SKIDMORE PUMPS

SKIDMORE CORPORATION
ST. JOSEPH, MICHIGAN

Every Air Conditioning Installation *deserves* SPORLAN PEAK PERFORMANCE... *Right Down the Line*





for no matter how large or small the installation... there's a Sporlan combination engineered to fit it PERFECTLY!

Sporlan Catch-All filter-driers with the famous molded porous core, keep systems perfectly clean, perfectly dry and acid free!

Sporlan's amazing new See•All moisture & liquid indicator shows whether the refrigerant is wet or dry and if the system is fully charged.

The superior design of **Sporlan Solenoid Valves** with Blue Seal Coils gives high MOPD ratings, permitting them to be used on applications with either refrigerants 12 or 22.

The Flow-Master element, exclusive with Sporlan Thermostatic Expansion Valves for air conditioning, minimizes valve hunting and smooths out evaporator performance.

Sporlan Refrigerant Distributors with the versatile interchangeable nozzles, not only permit a wide range of coil applications, but give uniform distribution to any number of circuits regardless of load or evaporator temperatures.

So... whether your next air conditioning job is large or small, buy Sporlan throughout and get Peak Performance Right Down the Line!

See your Sporlan Wholesaler today.

SPORLAN VALVE COMPANY
7525 SUSSEX AVENUE
ST. LOUIS 17, MO.
EXPORT DEPT. • 85 BROAD STREET • NEW YORK 4, N. Y.

Our 25th Anniversary...1934-1959

422 Reasons Why...

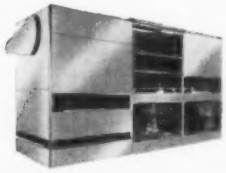
YOU CAN "DESIGN" YOUR OWN AIR CONDITIONING AT . . Governair

©SATISFABRICATED" TO SUIT YOUR REQUIREMENTS

Self-Contained Unit
With Evap. Condenser Type SCU

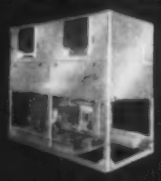
From 11 Basic Models
30 Possible Combinations

Self-Contained Unit
Multi-Zone Type SCMZ



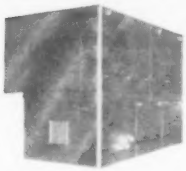
From 11 Basic Models
50 Possible Combinations

Self-Contained Unit
Shell and Tube Type ST



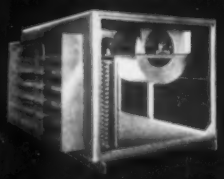
From 13 Basic Models
25 Possible Combinations

Self-Contained Unit
Multi-Zone Type STMZ



From 13 Basic Models
25 Possible Combinations

Horizontal Air Conditioner
Type GHC



From 14 Basic Models
56 Possible Combinations

Vertical Air Conditioner
Type GVC

From 14 Basic Models
56 Possible Combinations

Multi-Zone Air Conditioner
Type GMZ

From 14 Basic Models
84 Possible Combinations

Evaporative Condensers
Type EC

From 14 Basic Models
28 Possible Combinations

*ChillPak Water Chiller
Type CPS

From 10 Basic Models
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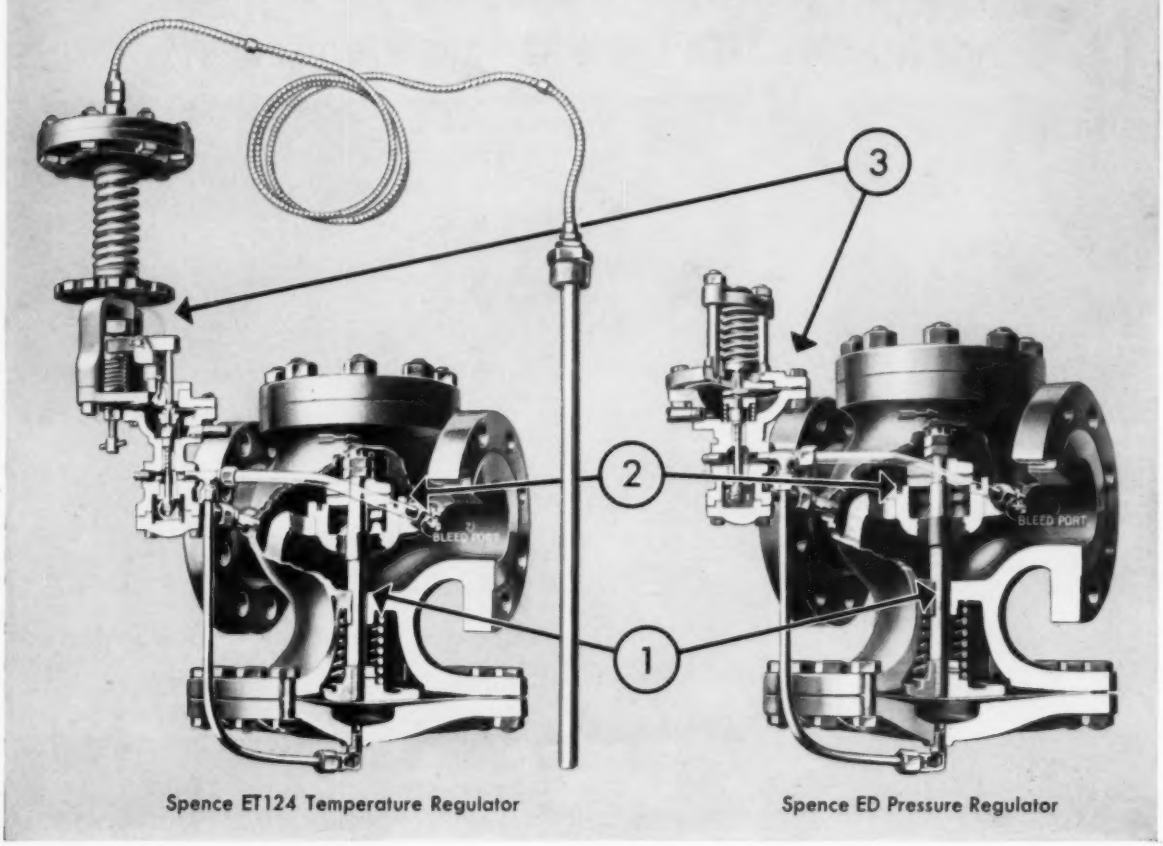
3 Tips for Low Maintenance in Automatic Regulating Valves



Spence ET124 Temperature Regulator

Spence ED Pressure Regulator

No engineer has to be told that downtime of regulating valves is costly—and a nuisance.

Nowadays the men who keep these valves operating want to make sure they aren't stuck with a maintenance headache for the life of their valves. That's why we are outlining this simple check list which covers three important features which keep maintenance costs down.

1. Stuffing boxes are probably the number one time consumer in valve maintenance. No matter how you figure it, repacking stuffing boxes is costly.

That's one reason Spence uses a "balanced" diaphragm construction which eliminates stuffing boxes. Simple stem guiding and large metal diaphragm operation reduce sticking and binding to a minimum.

2. Another problem is replacement of seats and discs when they've been cut by steam. Today you can forget about this problem entirely by insisting on an unconditional guarantee against wiredrawing. Spence, for instance, uses SECO Metal seats and discs and gives such a guarantee.

3. Any valve designed to control temperature and pressure within tight limits can be affected by dirt in the steam lines. You can't get a guarantee against this, but you can specify a valve that makes trouble shooting easy. Here's the tip:

Make sure your regulating valve is controlled by an external pilot. If trouble develops, it is easy to find out if it is in the pilot or the main valve with a simple test.

If the trouble is in the pilot, you can remove it without taking the main valve out of the line.

The quickest way to get the regulator working again is to install a spare pilot. This is easy—and in the Spence design it is not expensive to carry spare pilots. Spence pilots fit all sizes of Spence main valves.

These maintenance advantages plus other advanced features are available in a wide range of Spence automatic regulating valves. For more information write for the Bulletin TE.

SPENCE ENGINEERING COMPANY, INC.
Walden, New York

SE-144

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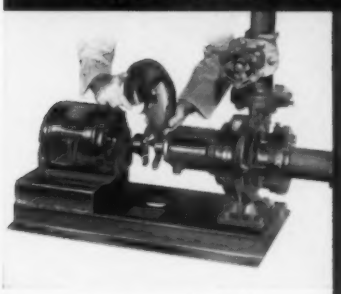
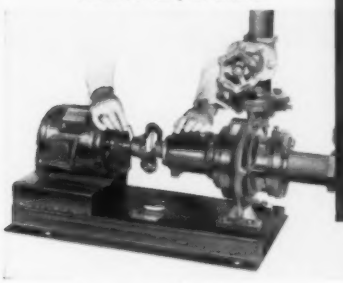
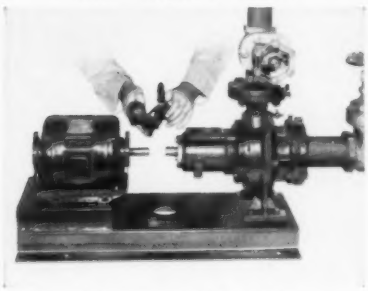
. . . no pipes to disconnect



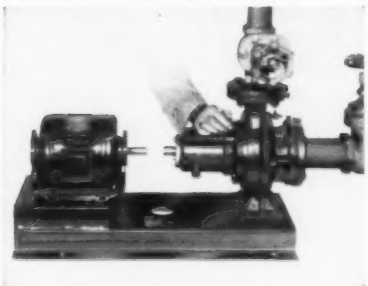
Remove coupler shield



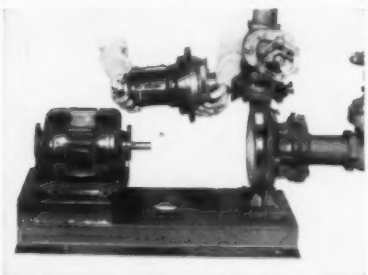
Loosen coupler set screws



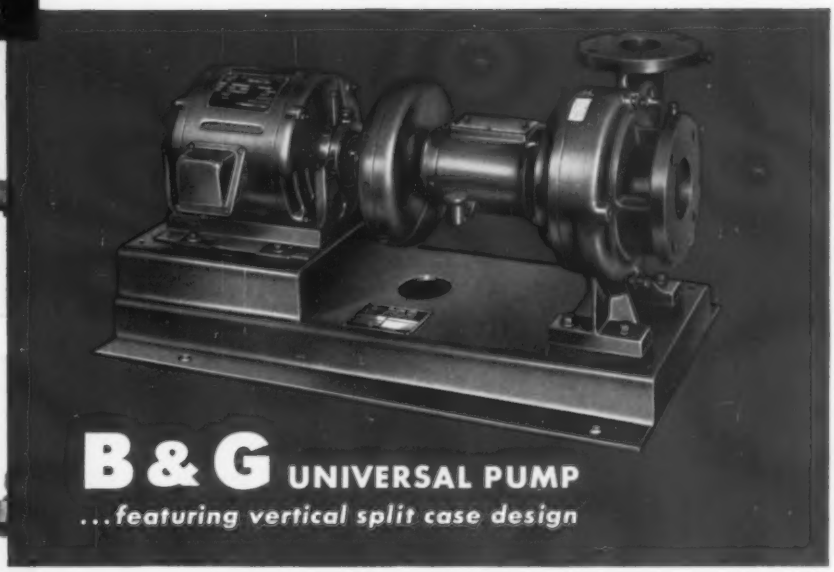
Slide coupler off the shafts



Remove volute cover cap screws



Lift out entire bearing frame and impeller



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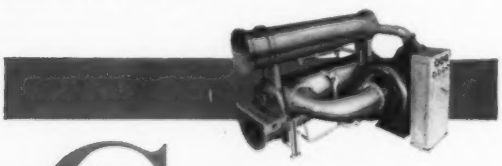
*New Houston, Texas home of Southwestern Industrial Electronics Co., a Division of Dresser Industries. Shown above: E. L. Andrews, Facility Director for Dresser Industries, Inc. *Consultants:* Bernard Johnson & Associates; Weldon W. Henderson, Consulting Engineer. *Architects:* Pierce & Pierce.



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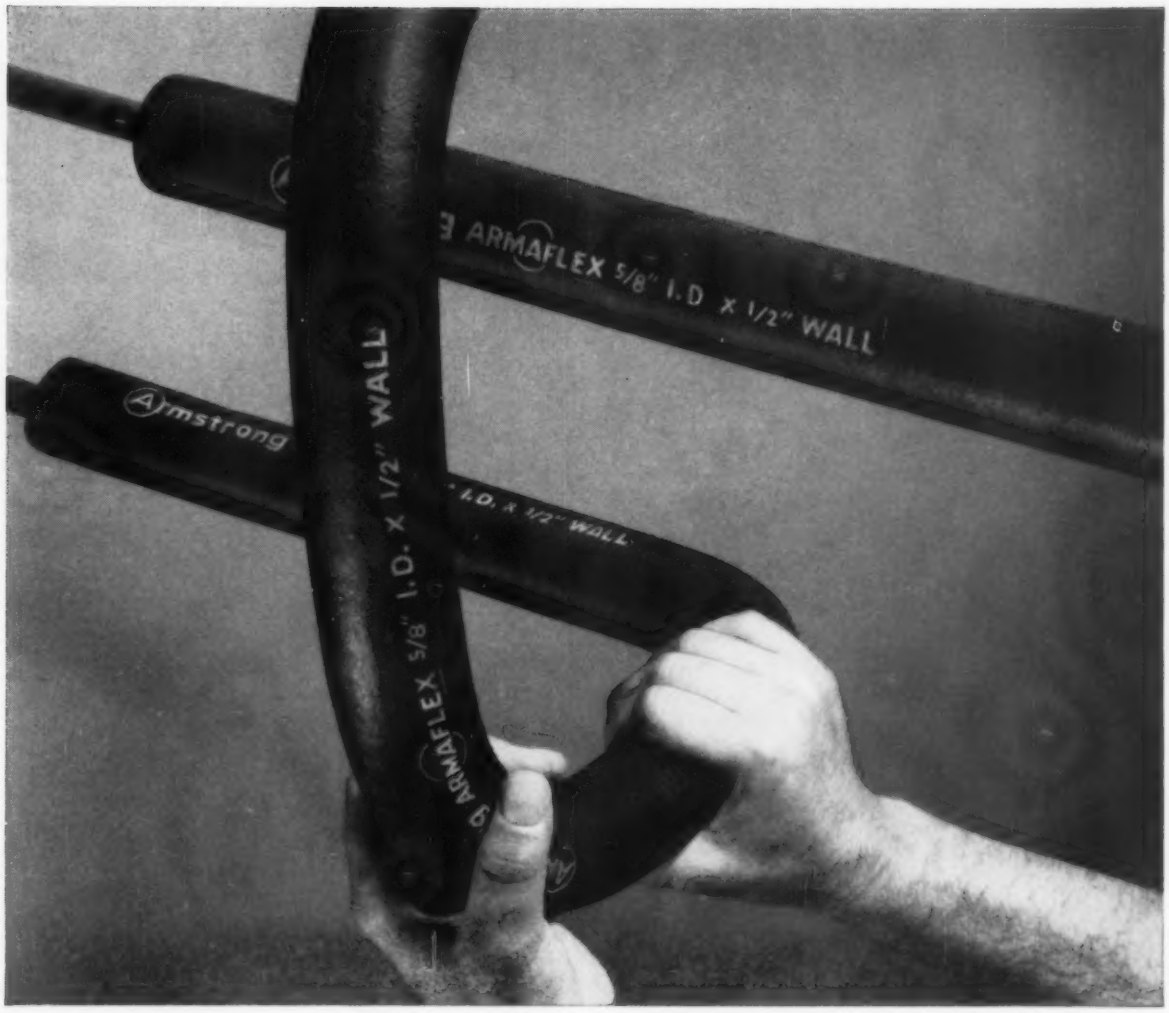

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"open for discussion"

• WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

Standardization in HPHW Design Pays Off in Central Heating Program

IT HAS BEEN most interesting to read the articles and the discussions brought forth these past few months on high temperature hot water systems. For the past three years I have been associated with the United States Air Force in the United Kingdom and have been particularly involved with the central heating program which has largely consisted of the use of high temperature hot water as a heating source.

You will, undoubtedly, be interested in the difference in terminology as used here in the U.K. with regard to the high temperature hot water system. The term, which has been in use for approximately three years, is *high pressure hot water*, or *HPHW*.

Due to the large number of facilities being designed by various U.K. engineering firms under the Air Force program, it was necessary that the designs be standardized.

It was required that the HPHW system be designed to operate at 320 F supply and 220 F return. Operating pressure is 100 psi. These design conditions were specified in order to simplify both operation and maintenance and to aid in the review of the consultants' work by our engineering staff.

Although HPHW systems have been used in the U.K. for some time in industry, they have not been used extensively for central heating. The lack of previous standardization in design would, in this case, cause considerable difficulty in the training of station engineers if the systems at the various Air Force bases operated at different temperatures and pressures.

It has been found that the term HPHW causes no confusion in the U.K. with anyone connected with central heating systems.

WILLIAM B. KOERNER
Mechanical Engineer
Daniel, Mann, Johnson & Mendenhall, Inc.
Grad Engineering Associates
Seelye Stevenson Value & Knecht
Architect-Engineers
Ruislip, Middlesex, England

Question Some of the Statements Made in Fuel Oil Heating Article

THE ARTICLE *Fuel Oil: What Every Heating Engineer Should Know*, by Willie Hammer (December 1958), is quite informative. The publication committee of our technical division (people from major oil company laboratories) has the following comments to make:

1) Measurement of API is *not* more accurate than measurement of specific gravity.

2) In the answer to the question, "If the outside temperature is low enough to drop the oil below its pour point, how can the oil be kept from congealing if heating coils are not available in the tank?" At the bottom of page 116, in the answer to this question, the addition of a lighter oil with a higher pour point is recommended. This should obviously read *lower* pour point.

3) Also, in this same answer, we are not sure the author wants to recommend blowing a fuel oil tank with compressed air.

4) In the discussion of what happens to sulfur, Mr. Hammer mentions the formation of SO_2 and its harmful effects. The real culprit is SO_3. Also, we can hardly conceive of a situation in which the sulfur in the fuel goes to H_2S.

5) The heat of combustion of sulfur should be compared to heating oil rather than to hydrogen and carbon separately.

6) The answer to the question about overheating fuel oils makes a point of the loss of carbon which could otherwise be burned in the furnace. The major problem that overheating of the oil can cause is the formation of solids which could plug the equipment.

R. H. L. BECKER
Managing Director
Oil-Heat Institute of America, Inc.
New York, N. Y.

THE AUTHOR'S REPLY—I shall comment on Mr. Becker's remarks in the order in which he puts them:

1) Since specific gravity is read to four places and API to three, use of specific gravity will be more accurate. The point in the answer given was that readings of API can be made more accurately because of scale intervals.

2) As Mr. Becker points out, this should read: "Add a lighter oil with a *lower* pour point."

3) Use of compressed air is not a normally recommended method. But in an emergency, drastic and unorthodox methods may be necessary to keep oil in very large outside tanks agitated to prevent congealing.

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"open for discussion"

continued

4) The combustion of sulfur in the presence of other materials may result in a number of end products. Since the SO_3 formed combines with water to form hot sulfuric acid, the result is corrosion of the enclosing surfaces. Normally, H_2S would not be given off, but an extreme shortage of air and oxygen in a malfunctioning furnace may result in formation of small amounts which are readily detectable.

5) The comparison of the heat of combustion of sulfur was made to illustrate the point that sulfur burns with less heat output than either carbon or hydrogen. The method shown by Mr. Becker actually illustrates the calculations to show the reduction in heating effect by the presence of the sulfur.

6) My article tried to indicate that the serious result of overheating fuel oil is the necessity for cleaning tubes and piping to avoid stoppages.

WILLIE HAMMER
Chief, Installations Branch
Hq. Ordnance Weapons Command
Rock Island Arsenal
Rock Island, Ill.

Cost Savings in Nuclear Piping Systems Are Found in Initial Design Stage

WE ARE at the present time involved in a development program for the Atomic Energy Commission and consider that the article *Atomic Age Radiation Hazards Stiffen Safety Standards*, by Raphael S. Lubomirski (January), in general is very timely and interesting. The author has identified many of the technical problems which at this point are imposing serious cost penalties on our efforts to achieve economically competitive power from nuclear fission. In the face of a somewhat disconcerting variety of plant concepts, it is some comfort to realize that the functional and environmental requirements for piping components can be generalized to a significant degree.

In the area of valve and flow control device designs, it is reasonable to expect such special requirements as zero stem leakage and absolute vessel wall section integrity to result in formidable cost penalties. Furthermore, there are serious limitations on the degree to which refinements in details, experience, improved technique, and that old cliche "quantity production" can reduce these costs.

Some of the most important opportunities for cost break-throughs can only be found in the initial design stage. To provide these opportunities it is necessary that the specifications be limited, to the greatest practical degree, to the purely functional requirements of the specific item.

The designer must then seek the best means for providing these functions. Existing designs should be analyzed not only in regard to meeting these requirements, but also with the thought that perhaps unneeded functions are also provided, complicating the cost picture without adding utility.

Possible new design approaches may be suggested by the functional specifications. Just as endless refinement of paint brush design could never produce the paint roller, so we must be completely objective in our conceptual design of nuclear plant components.

Time and experience will take care of many things, but we cannot afford to sit back and wait.

B. J. MILLEVILLE
Director of Engineering and Research
Ohio Injector Co.
Wadsworth, Ohio

Stack Effect Infiltration Article Leaves Some Questions Unanswered

IN HIS ARTICLE *Here's How to Figure Infiltration Due to Stack Effect* (December 1958), Ralph J. Abramson introduces some interesting calculations in answer to his introductory question, "How much should a heating engineer add to the design load of a building to account for infiltration resulting from stack effect?"

Summarizing briefly, the stack velocity pressure of air moving upward in a building, due to the difference in temperature between inside and outside air, at some point equals the horizontal velocity pressure of the wind. This is called the *neutral point*. It exists in a multi-story building with unsealed windows and unsealed vertical openings between floors, when the wind is blowing at less than extremely high velocities. Calculations are included for approximating the neutral point, including the effect of an adjoining building upon the wind.

Mr. Abramson's article brings to mind the following questions and comments.

1) How should the calculations or the neutral point be used to answer the introductory question?

2) Does infiltration due to stack effect necessarily cause an increase in the heating load of a building at design conditions? That is, would the heating load of a building increase if sealed vertical openings between floors were unsealed, assuming the same temperatures in both cases?

3) How is it possible, as stated, to provide sufficient air pressure to counteract exfiltration above the neutral point? It seems as though pressure sufficient to offset stack effect from below and wind on the windward side would result in exfiltration on the leeward side of the building. The method used to prevent exfiltration by means of air pressure inside the building probably should be explained.

4) Probably the most recent work regarding the problem of infiltration is ASHAE paper No. 1615, pages 453 to 476 in the 1957 Transactions. A definition on page 455 is: "The neutral zone is that elevation in a building where the pressure indoors is equal to that outdoors when the building is exposed only to an indoor-outdoor temperature difference." The distinction between the terms *neutral zone* and *neutral*

point should be noted in calculations involving infiltration.

5) Have any calculations using Equations 5 and 8 been compared with actual observations, or even with reasonable assumed values? Substitution in the equations of the values $S = 16$ floors, $V_e = 15$ mph, $H = 200$ ft, $E = 1$, $T_1 = 70$ F, $T_o =$ zero F, and angle to ground $= 2$ deg results in a value of 0.1086 in. for horizontal wind velocity pressure P_w, and a value of 7.28 in. for stack velocity pressure P_1. This obviously is in very poor agreement for values that should be equal. Perhaps an example to illustrate use of the two formulas will clarify this.

R. A. Parsons
Board of Water & Light
Lansing, Mich.

The Author's Reply—Before answering Mr. Parson's specific questions, I wish to demonstrate some simple mathematics, using equations from Chapter 11 of the 1958 ASHAE Guide. They are:

$$P_w = P_v \quad \text{.....[1]}$$

where:

P_w = horizontal component of wind pressure, in. WG
P_v = stack pressure due to temperature difference, in. WG

$$\Delta T = T_i - T_o \quad \text{.....[2]}$$

where:

T_o = outside temperature, F
T_i = inside temperature, F

$$P_v = (V/4005)^2 \quad \text{.....[3]}$$

where:

P = total pressure due to velocity

and

$$V = Q/A$$
$$Q = K\sqrt{h\,(T_i - T_o)}$$
$$Q = EAV$$

Note that EV = effective velocity in fpm $= K$.
For P_w; then $E = 0.65$ and then:

$$EAV \approx K\sqrt{h\,(T_i - T_o)}$$
$$\approx 9.4A\sqrt{h\,(T_i - T_o)}$$
$$EAV/9.4A \approx \sqrt{h\,(T_i - T_o)}$$
$$0.65\,V/9.4 \approx \sqrt{h\,(T_i - T_o)}$$
$$\approx 0.0693V\sqrt{h\,(T_i - T_o)}$$
$$(0.0693V)^2 \approx h\,(T_i - T_o)$$
$$0.0049V^2 \times h\,(T_i - T_o);$$

but

$$T_i - T_o = \Delta T$$

and approximately

$$0.005V^2 \approx h\,\Delta T$$
$$V^2 \approx (h\,\Delta T/0.005) \approx 200h\,\Delta T$$
$$P_v = V^2/(4005)^2 \approx 200h\,\Delta T/(16 \times 10^6)$$
$$\approx 12.5 \times 10^{-6}\,h\,\Delta T = 0.125 \times 10^{-4}\,h\,\Delta T$$
$$P_w = (88V_w/4005)^2 = (V_w/45.4)^2 =$$
$$(0.022\,V_w)^2 \approx 0.0005\,V_w^2$$
$$= 5 \times 10^{-4}\,V_w^2\ (V_w \text{ in mph})$$
$$P_v = P_w \text{ (equal pressures)}$$
$$0.125\,h\,\Delta T \times 10^{-4} = 5 \times 10^{-4}\,V_w^2$$
$$0.025\,h\,\Delta T = V_w^2$$
$$h = V_w^2/0.025\,\Delta T$$

"open for discussion"

continued

$h = 40V_w^2/\Delta T$
(V_w in mph horizontal component)

Wind, mph, V_w	ΔT	h, ft above grade	ΔT	h, ft
1	80°	0.5	15°	2.7
3		4.5		24
5		12.5		66.7
7½		28.1		149.5
10		50.0		267
15		115.0		600

It should be noted from these calculations that the neutral point varies with two factors: the horizontal component of the wind velocity and the difference in temperature between outdoors and indoors, as illustrated in the table.

The equations developed in the article go one step beyond this as they recognize changes in the constants quoted in Chapter 11 of the Guide and are to be used to prepare a table similar to that illustrated herein. It must be borne in mind that the neutral point where the pressures are relatively equal is not similar to an airtight chimney. The reason for this is that infiltration and exfiltration through window crackage occurs at different rates and in different directions (exfiltration and infiltration) based on the variation in wind direction, velocity, and temperature difference. These new constants merely point to the *neutral zone*. They should not be used to determine *maximum pressure*. It is obvious that maximum pressures will not follow this equation because of the increments of leakage and pressure which vary simultaneously with the above conditions.

However, for the design condition of 15 mph (horizontal wind component) and recognizing crackage as a factor, we can arrive at a *theoretical* point which will be sufficiently accurate for determining the amount of *pressurization* desirable for horizontal interior pressure zoning.

The infiltration due to stack effect generally creates excessive leakage from the interior of the building at the upper floors and excessive infiltration at the lower floors, adding a considerable heating load or cooling load to the system. As the calculations point out, *horizontal zoning* of one to several floors per zone can reduce this heat loss or heat gain markedly.

Further, it indicates that provision of *horizontal closures* to reduce the vertical air column and by the same token, "stack effect," is a most desirable economy that can be made in multi-story buildings. It is possible to provide sufficient air pressure to counteract either exfiltration or infiltration by the above mentioned methods if we are dealing with relatively low stack effect conditions created by horizontal zoning or, in other words, *sealing the building in horizontal sections* as indicated by the calculations.

It must be borne in mind that, when a building is horizontally zoned, each zone must then be determined individually for maximum and minimum infiltration and for additional exfiltration rates *and* leakage

through shafts and other vertical openings that cannot be readily sealed.

The difference between neutral zone and neutral point can be distinguished as follows:

The *neutral zone* of a multi-story building is that point, considering the building as an open rectangular solid with penetrations (crackage), where the interior column pressure exactly equals the horizontal wind component on the exterior at a given instant of time. Note that this will vary with wind direction, velocity, and temperature difference ($\triangle T$).

The *neutral point*, however, is a *selected* point by horizontally zoning the structure arbitrarily and recognizing that the horizontal component aids infiltration and the vertical downward component aids exfiltration.

I have full confidence that a thorough perusal of Chapter 11 of the Guide, the simple calculations contained herein, and the article itself should create in the reader's mind a simple and usable method of arriving at the most economical horizontal zoning and the most economical system for pressurizing these components.

R. J. Abramson
R. J. Abramson & J. M. Klipp
Consulting Mechanical Engineers
Chicago, Ill.

Standardization Via Check Lists Is Means to Assure Uniform Results

I APPRECIATE Mr. Scharres's comments ("Open for Discussion," February) on my Data Sheet, *Heating, Ventilating, and Air Conditioning Check Lists for Coordinating Drawings* (January), and feel gratified to know that he, too, has recognized and given serious consideration to this same design problem.

I sense in his comments that he expresses a degree of wariness concerning standardization and check lists *per se*. It is rather difficult for me to understand this aversion towards specially devised means for improving quality of work. The use of standardization does not imply automatically the reduction of brainpower; it is merely the recognition and exploitation of routine functions occurring in a more or less fixed sequence which, when faithfully executed, produce anticipated results. Industry uses standard techniques to assure uniform results. Commercial enterprises use standardization in various forms profitably and to their customers' satisfaction. Airlines use checkoff lists for pilots' operational procedures to insure greater safety to equipment and personnel. I doubt if anyone earnestly disputes the fact that standardization of routine functions is an inevitable pragmatic necessity, regardless of the field in which it is applied.

It is my hope that the check lists in the Data Sheet will not only be helpful to young men starting out in engineering, but that these lists will prove to be quick, dependable references to the long practicing designers who must develop accurate drawings under the pressure of the very compressed design production schedules which are becoming the norm today.

It is my belief that a printed checkoff list is more reliable and efficacious near the end of a project than a memorized list blurred by the heightened production tension and pyramiding drawing development details. The check lists are not intended to reduce concentration, but actually to stimulate thinking and to alert engineers to certain items which might be overlooked otherwise or which have been painfully missed on some past project and cannot bear to be forgotten again.

Some other very important advantages of a printed list are that it can be readily distributed to all employees concerned; it can be modified when need be; and it does not restrict the communication of experience and personal growth as does the word-of-mouth method.

Mr. Scharres mentions the not unfamiliar period of incubation of the client's building program plans which seem to hatch overnight. While this is very true, the client is generally not sitting on the architect's preliminary studies by his own choice. His hands are usually tied by the complexities of his own business organization structure, fiscal appropriation regulations, and budget approval processes.

Therefore I would be inclined to disagree with the thought that copies of these check lists might be sent to the owner so that he may in turn be more sympathetic with the engineer's task of preparing contract drawings and specifications under such accelerated conditions. That is the architect's and engineer's lot and they have to accept it with a grin. Do not circumstances such as these make one consider that engineers must resort more and more to methods and devices which will help them keep apace with and successfully meet the requirements of their clients' modern geared-up construction programs? Experience indicates that a client's attitude toward architects and engineers depends solely on how well they serve him, regardless of the circumstances.

John W. Harjan
Voorhees Walker Smith Smith & Haines
Architects and Engineers
New York, N.Y.

IN THE article *High Pressure Steam and Air Piping Serves Experimental Jet Catapults*, on pages 110-112 in the February issue, the author was listed as "Milton Simkin, vice president, Charles Simkin & Sons, Inc." This credit should have been given to Arthur J. Riegert, project engineer with that same firm.—Ed.

when special service is needed . . .

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To be opened in Fall of 1959 . . . The Sinai Hospital, a new $19,000,000, 423 bed, seven-building Medical Center in Baltimore, Md.
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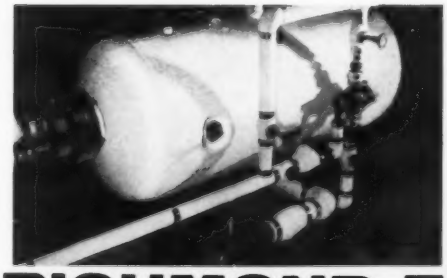

Inside hospital operating rooms, temperature and humidity must remain constant.

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What Is Best Induced Draft Fan Location?

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with answers from two readers. Other answers are invited.

"I would like to know how the best location for an induced draft fan can be determined. Also, what factors should be considered in positioning the fan after the location has been selected?"—D.H.S.

Size, Type of Boiler Determine Best Induced Draft Fan Location

THE BEST location for an induced draft fan will depend on the size and type of boiler the fan serves. In the small industrial plant using packaged type boilers, no induced draft fan is required on some units. These range in size from 15 to 600 hp and come equipped with built-in forced draft fans.

In larger plants (2000 hp and over) the type of boiler will have a bearing on the location of the induced draft fan. On a boiler with an economizer and an air preheater, place the induced draft fan after these units in the gases flowing to the stack. This is important so that the fan handles the flue gas at the lowest possible temperature. With all other conditions equal, the horsepower required to operate the fan will be less when handling gases at lower temperatures.

Wherever possible, the induced draft fan should be located on the main boiler room operating floor or in the basement of the boiler room. Keep the ductwork as short and as direct as possible. Fans should be located on a good firm concrete foundation to minimize vibration.

With some types of boilers it may be possible to locate the induced draft fan on a mezzanine floor. In this case the mezzanine floor should be of reinforced concrete.

In a plant where several boilers connect with breeching to a common stack, each boiler should have its own induced draft fan with the proper air flow volume and static pressure. Extreme care should be exercised as to the size and arrangement of breeching in plants of this type. Avoid abrupt offsets in ducts and breechings.

Ample clearance should be allowed around the fan and the fan drive unit for maintenance. Provision for access and inspection doors should be made in the ductwork. Some type of flexible connection should be provided between the fan and the duct or breeching.

Fig. 1 shows a fan arrangement for a large capacity boiler using an air preheater and both forced and induced draft fans.

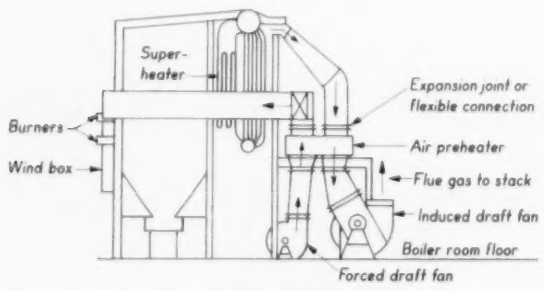

Fig. 1

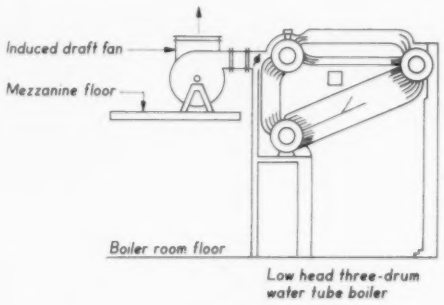

Fig. 2

Fig. 2 shows a fan arrangement for a three-drum water tube low head boiler with the induced draft fan located on the mezzanine floor. The forced draft fan is usually located on the boiler room floor and the air to the burner windbox is passed under the combustion chamber to preheat the air to the burners. With this arrangement the flue gas outlet from the boiler would be split into two equal ducts to the inlets of the induced draft fan.

SHELDON R. HIGGINS
Mechanical Engineer
Long Beach, Calif.

Design to Eliminate Capacity Loss, Reduce Vibration, Minimize Noise

LOCATION and positioning of a fan and arrangement of ducts are important criteria for satisfactory performance. Minimizing capacity loss, vibration, and noise are factors to be considered. Reduced fan capacity may result from inlet air spin, non-uniform air

Specify ELLICOTT Storage and Processing Vessels

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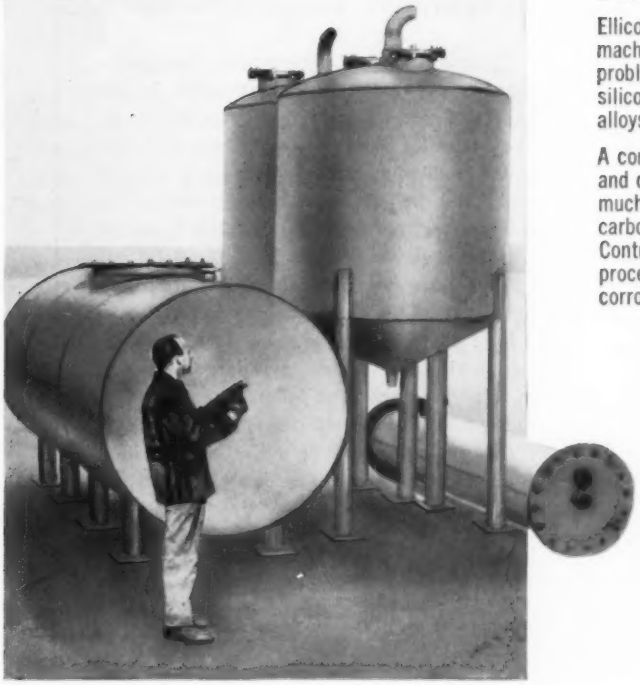

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distribution, and/or lack of sufficient space between fan and neighboring walls or other structures.

When direction of air spin is the same as fan rotor rotation, capacity will be reduced and resulting power requirements will decrease. With spin opposite to wheel rotation, power requirements and noise will increase. Spin may result from faulty duct design and/or obstructions to flow. The centerline of coils, filters, and other appurtenances should coincide with that of the fan.

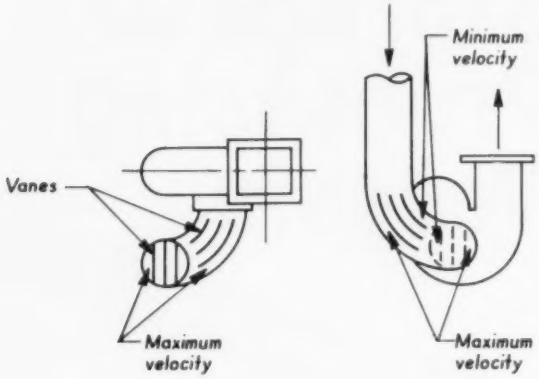

Fig. 1

Compound curves at the fan inlet should be avoided. If they cannot be eliminated, use of vanes will modify the resulting adverse performance. Fig. 1 shows details. Similarly, the effects of non-uniform air distribution can also be lessened by correct installation of vanes.

Minimum space between fan inlet and walls is required for satisfactory operation. Recommended least distance is one-half fan wheel diameter, with greater values offering better operation. Fig. 2 shows these relations.

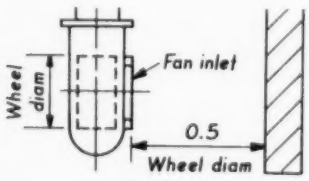

Fig. 2

Size and direction of ducts at fan outlet should be unchanged for as great a distance as available space will allow, with minimum length not less than one-half fan rotor diameter. Discharge into a duct having larger area than fan outlet should not be abrupt, since high energy losses will result due to turbulence. A transition piece of sufficient length offers maximum energy regain. For the latter, the included angle between duct sides should not exceed 15 deg, as shown in Fig. 3.

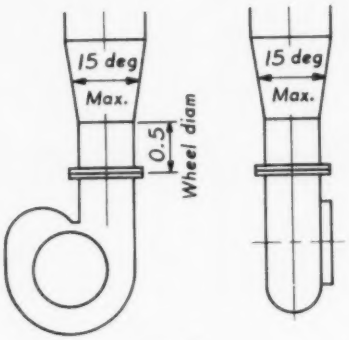

Fig. 3

Installation of elbows at a fan outlet should be avoided. However, if these conditions are necessary, rotating the fan housing 45 deg allows use of a 45 deg elbow limiting directional changes in the duct. Where this is not practical, vanes may be employed to reduce turbulence. Since a velocity gradient occurs inside an elbow, locating the latter to provide greatest velocity at the outer radius will minimize the pressure drop (Fig. 1). In addition, noise and vibration will also be limited.

H. B. Wayne
Consulting Engineer
Woodhaven, N.Y.

READER ASKS —

"Will Increased Boiler Water Temperature Cause Corrosion?"

"I have charge of the operation and maintenance of hot water boilers which supply heat and hot water to apartment buildings. The hot water is supplied by means of boiler water circulating through coils in a storage tank. The boilers have been operating at temperatures between 190 and 200 F, and at a water pressure of 22 psi.

"We have been having trouble supplying hot water at the proper temperature, due to a load which is now greater than originally designed. One solution considered was that of raising the operating temperature to 210 F. Other conditions would remain the same. Are there any corrosion or other deterioration problems which will arise due to raising the temperature to 210 F?"—M.U.

• *YOU ARE INVITED to contribute a question for publication or an answer to a published question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

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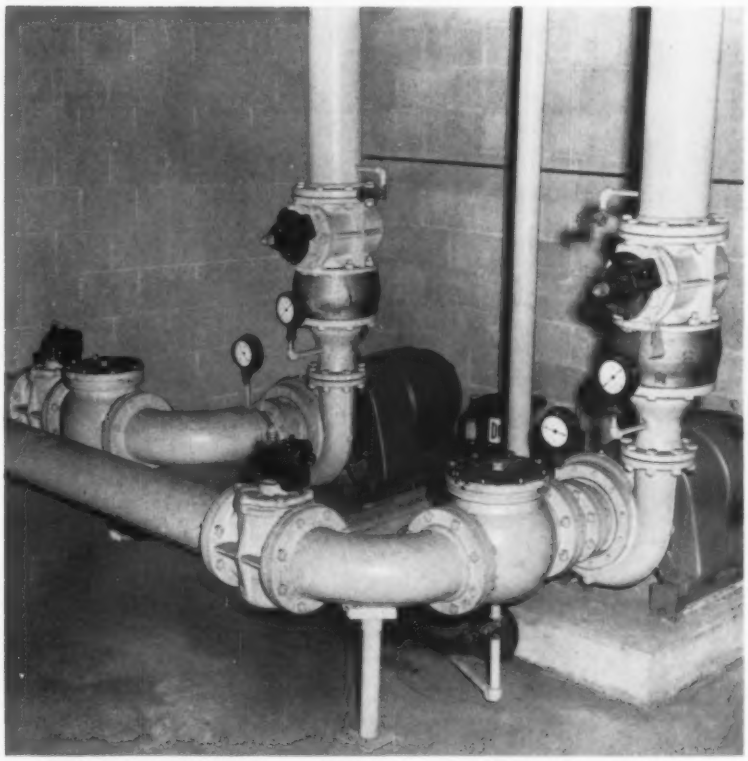
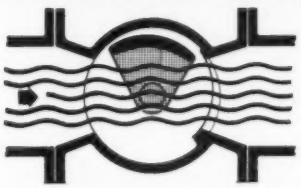


PRESSURE DROP IS LOW!



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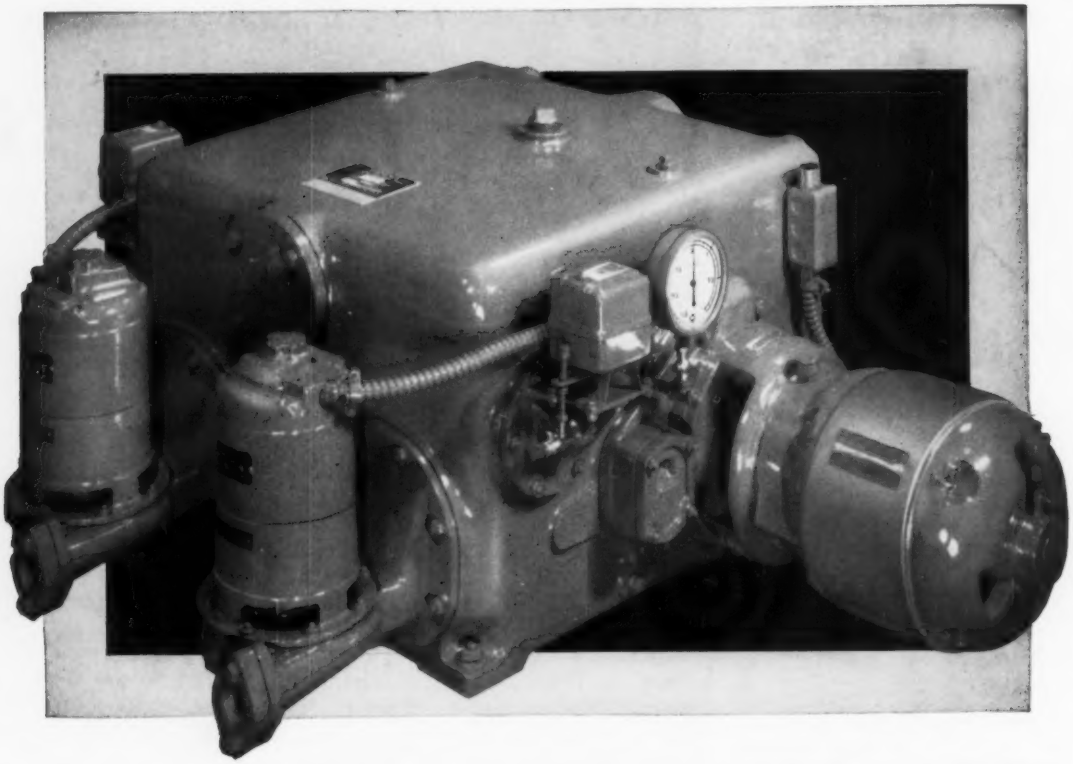

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These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

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Choose Central Plant, Buried Piping To Air Condition Three-Area Campus

Two package boilers deliver steam to two 800 hp turbines which drive two refrigeration compressors. Expansion plans include provision for one additional boiler, two 1500 ton compressors. Nine miles of chilled water, steam, and condensate piping—buried underground—connect central plant with campus buildings. Chilled water flow is constant; water temperature is varied to meet fluctuating needs.

BY IRWIN ISAACSON, JR.
and
WILLIAM R. PITCAIRN, JR.
Leo S. Weil & Walter B. Moses
Consulting Engineers

• A central plant for air conditioning the three-area Tulane University campus was chosen after three alternate methods were studied. As the number of buildings to be cooled increased beyond the existing 12, the cost of individual plants approached and then exceeded that of the central plant. Also, the operating and maintenance costs for the central system was lower. Another factor leading to the decision for a central system was that the existing steam distribution system was in bad condition and had to be replaced.

Three methods of installing the piping were considered. After studying walk-through tunnels, overhead piping, and direct burial, the last was chosen because of economy. The steam and chilled water lines were well insulated and protected from moisture permeation by application of several layers of mastic, enamel, glass cloth, kraft paper, and tape.

Irwin Isaacson, Jr. received his B.E. degree from Tulane University in 1947. He has been with Weil & Moses since that time, both as a field engineer in the company's St. Louis office and in his present capacity as design engineer and specification writer. He is a registered mechanical and electrical engineer in the State of Louisiana.

William R. Pitcairn, Jr. was graduated from Carnegie Institute of Technology in 1940 with a B.S. in mechanical engineering. Since 1946 he has been a design engineer for Weil & Moses.

IT'S BEEN SAID that New Orleans has four seasons: December, January, February, and summer. The conventional school year has its four seasons: June, July, August, and school. Thus, even with the two-semester school year, there are about six months a year when air conditioning would be beneficial.

Today, with college and university training in more demand than ever, the 12-month school year is becoming prevalent. Good judgment dictates that all classrooms, dormitories, and recreational buildings in this climate should have year 'round air conditioning.

Tulane University recently had to face the problem of whether to provide an individual air conditioning system complete with boilers, refrigeration equipment, and pumps for each of its new and existing buildings, or to centralize the equipment in one location to serve all the buildings. In order to arrive at a decision, the consulting engineers, in conjunction with the university's planning and maintenance staff, studied the initial cost, maintenance cost, power and fuel cost, and convenience of operation of both types of systems.

Study Three Alternatives

One study was made of the cost of installing a central plant for generating chilled water and steam for distribution to the various buildings on the campus. Another was made of the possibility of installing two central plants, one to serve each section of the campus, in order to reduce pumping and piping costs. A third set of figures was made up on the construction of a separate central steam plant for heating and individual cooling plants in each of the buildings.

Tulane now has 12 air conditioned buildings, including those under construction. Ultimately, there will be over 50 buildings on the campus to be heated and cooled. Some of these are existing, some are under construction, and some proposed.

Central Plant Cost Favorable

A careful analysis showed that the first cost of providing a central plant to take care of 12 existing air conditioned buildings was more than the total cost of providing an individual plant for each building. But, as the number of buildings to be air conditioned was increased, the sum of the costs of the individual plants approached and then finally exceeded the cost of the central plant and distribution system. However, even for the number of buildings which are to be conditioned in the first step, the operating and maintenance cost was much lower with the central system than with the individual plants. This was due to several factors:

1) The cost of generating chilled water with steam is low.

2) By centralizing all operations in one plant, low gas and electric costs are obtained.

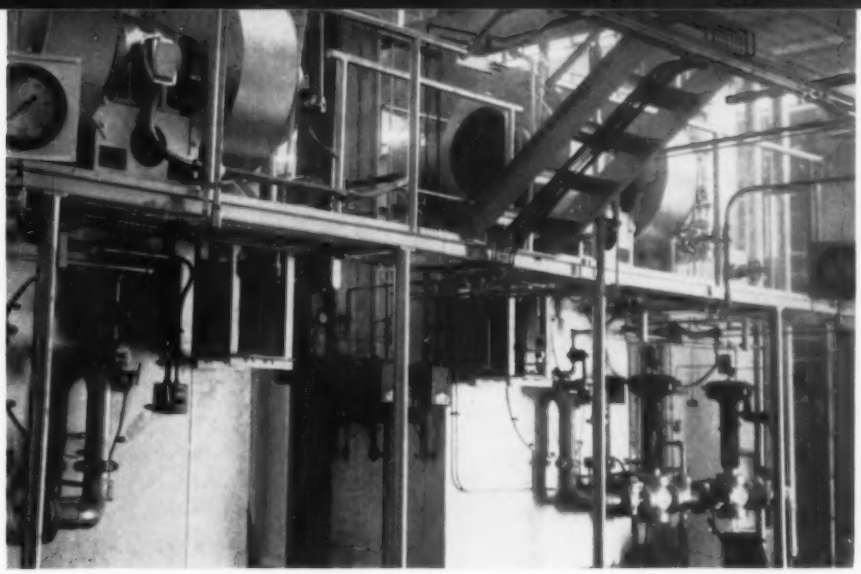
3) A special discount is offered by New Orleans Public Service on air conditioning power, as compared with power and light for other purposes. By concentrating the main equipment in one building, it is possible to take advantage of this discount. It would have been necessary to run duplicate feeders over the entire campus to get the same discount with plants located in individual buildings.

4) Cost of maintenance of a central plant will be much lower than for scattered refrigeration plants around the campus.

5) Likewise, operating personnel will be far fewer when concentrated in one central plant than if divided into separate crews in many buildings.

Replace Existing Steam Lines

Another factor that led to the decision for a central distribution system was the fact that the steam distribution system around the campus was in very bad condition and required replacement. Since the new plant was



TULANE'S central heating and air conditioning plant houses two package 48,000 lb per hr steam boilers. Steam is delivered to two 800 hp turbines which drive two refrigeration compressors for summer cooling. Steam also supplies winter heating and summer reheat needs. One wall of plant is removable and space is set aside for future addition of another boiler, two 1500 ton compressors

already planned, the existing steam lines were patched and kept running until the new ones were installed and put into service.

Plant Serves Three Areas

The Tulane campus divides itself into three sections: The original section runs from St. Charles Ave. to Freret St., the central section from Freret to Willow St., and the rear section from Willow to Claiborne Ave.

The major part of the present and proposed air conditioning load is in the area between Freret and Willow Sts. It was decided that this area should be served from a plant located between these two streets.

The advisability of serving the front section of the campus from Freret to St. Charles from another plant in this front area was considered, but was rejected because:

1) It would require a completely separate operating crew.

2) The distribution pipe work for water and steam serving the central campus would have to be run to Freret St. to take care of buildings in the center section. There would be no great increase in cost if these lines were carried across Freret St. to serve the front campus, as compared with the cost of running separate lines around the front campus from a plant located in this area. The existing underground heating lines on the front campus were in very bad condition and required replacement. New lines would also be needed for chilled water and, since these lines must be installed in any event, it was determined that by paralleling steam and chilled water lines in one trench, it would be more economical to serve the front campus from a plant on the central campus between Freret and Willow Sts.

3) Another reason in favor of this plan is the reduction in fuel cost that would result by metering all purchased gas in one location. Originally, there were two boiler rooms, one on the front campus and one on the central campus. The gas supplied to each of these plants was metered separately. This meant that the rate for gas in each location was on the highest part of the schedule of gas charges, whereas, by combining all the gas used on one meter, a lower basic rate for gas would result. This difference in gas cost would be materially increased as the use of gas grows with the construction of new buildings and the air conditioning of existing buildings.

It was also decided that the rear campus could best be served from the plant located on the central campus for the same reasons discussed.

Cooling to Total 4600 Tons

The maximum air conditioning load to take care of buildings now under construction and those which are presently air conditioned (after due allowance for diversification) was calculated at approximately 1600 tons. The minimum load would probably not exceed 15 percent of the maximum.

To carry this minimum load without unstable operation of the compressors and to provide for better economy in operation, it was decided to install two 800 ton compressors to take care of the first step in power plant construction.

As the program for air conditioning of existing buildings and for adding new buildings on the campus progresses, two additional 1500 ton compressors are proposed to provide an ultimate capacity of 4600 tons.

Select Turbine Drives

In selecting the compressors, consideration has been given to steam turbine drive and motor drive. It was determined that there would be a saving of about $1700 per month if steam turbine drives were used. The difference in first cost between the turbine driven and motor driven compressors with all services and auxiliaries was found to be very nominal, and the saving in operating cost fully justified the use of turbine driven compressors. This saving is for the first phase of the power plant construction only (two 800 ton machines), and should be multiplied as the capacity is increased.

Electric motors of the induction type were selected for the cooling tower fans and all pumps, with the exception of one turbine-driven boiler feed pump.

The condensing water system is designed to operate the refrigerant condensers and the steam condensers serving the turbines in series. Water leaves the cooling tower at 87 F, leaves the refrigerant condenser at about 95.3 F, and then passes through the steam condenser, returning to the tower at about 106 F.

Three condensing water pumps are provided, one of which is a spare. These are manifolded and valved so that when two refrigerating machines are in service, two condensing water pumps are in operation and, when only one machine is in service, one pump is run. This, of course, makes a substantial saving in operating cost.

The steam turbines have a water rate of approximately 12½ lb per bhp per hr when operating under normal full load conditions.

Save Piping, Pumping Costs

For the type of summer cooling job to be performed, it is usually economical to circulate about 2½ to 3 gpm of chilled water (about 44 F) per ton. However, in a central system of this magnitude, the piping and pumping costs for the chilled water become major expenses.

By circulating less water at a lower initial temperature, these costs are reduced. But acting to offset this advantage is the fact that the lower chilled water temperatures mean larger refrigeration machinery and lower refrigerant suction temperatures with consequent higher power costs for refrigeration.

An analysis of all these factors indicated that it would be most economical to circulate 1½ gpm per ton at 38 F leaving and 54 F returning. Water at 38 F is too cold for most comfort cooling applications since excessive dehumidification and control problems may result.

Therefore, at each building a pump is provided to mix primary chilled water from the underground loop at 38 F with return water from the building at 54 F and deliver the resultant 45 F mixture through the cooling coils in the building. The temperature and flow of chilled water in each building is thus under local control and when air conditioning in a building is not required, no chilled water is diverted there.

One of the problems posed by the small quantity of water to be circulated through the pipelines was that of maintaining proper velocity in the tubes of the chillers. After careful investigation, it was decided to operate the two chillers in series with proper bypass arrangements so that the flow rate through them would be maintained at 3 gpm per ton at all times — regardless of whether one or two machines are operating. With two operating in series, the load would be divided as follows:

Machine No. 1: Developed capacity: 859 tons at full load: 760 bhp
Machine No. 2: Developed capacity: 741 tons at full load: 656 bhp

Under these operating conditions, the first machine would lower the water temperature from 54 F (at which temperature it is returned from the campus at full load conditions) to 45.4 F. The second would further lower the water temperature to 38 F, at which it is distributed.

When only one machine is operated, the developed capacity would be 800 tons and the brake horsepower at full load would be 805 hp. Under these conditions, the chiller would lower the water temperature from 46 F, at which it returns from the campus, to 38 F.

From these figures it is obvious that the system is designed for circulation of constant volumes of water, with load variation taken care of by varying the range of temperature. The plan is to deliver 2400 gpm of 38 F water from the plant and return the water to the plant at a higher temperature, depending on the load.

Because of the length of the piping system, it was decided to provide a compressed air chamber in the chilled water system in the boiler plant. The chamber is held under sufficient air pressure to keep the water in all buildings at full height in the pipes when the pumps are shut off. The chamber also serves as a shock absorber should a valve in the system be closed against pumping pressure.

The power plant for the first phase of installation includes two package boilers, each having capacity to generate 48,000 lb per hr of saturated steam at 250 psi. This steam is used to drive the two 800 hp turbine driven refrigeration compressors for summer cooling as well as to supply winter heating and summer reheat (for control purposes).

One wall of the building is removable and space has been left for enlarging the plant to house two future 1500 ton compressors and an additional 48,000 lb per hr steam boiler.

For centralized observation and control of the plant, a graphic panel has been provided. On this panel, flow diagrams for chilled water, condensing water, steam, and condensate are color coded.

By means of pushbuttons and a master thermometer it is possible to read the temperature in any of these systems. In addition, meters indicate flow of condensing water, chilled water, turbine condensate, and condensate return from the campus.

Spare pumps were provided for the various pump applications to allow for breakdown of one pump.

Condensate from the campus and turbines is passed through a deaerating feedwater heater before being returned to the boilers. All makeup water is softened and treated.

A new gas meter installation was required to serve the boiler installation with natural gas. This meter station is located outside the plant.

Nine Miles of Piping

From the power plant to S. Claiborne Ave. is a distance of 3300 ft, and from the plant to St. Charles Ave. is 3000 ft. Based on the ultimate refrigeration and heating requirements of the university, piping required for the project was 23,600 ft of 2½ to 16 in. pipe for chilled water, 11,900 ft of 1½ to 10 in. pipe for steam, and another 11,900 ft of 1 to 4 in. pipe for condensate return — about 9 miles in all.

In installing this piping, three general methods were considered: walk-through tunnels, overhead piping in covered walkways above sidewalks, and direct burial.

The tunnels, of course, would offer

the advantages of ease of maintenance and inspection and accessibility for additions and alterations. In most cities this would have been the choice in spite of the higher cost. However, New Orleans has an extremely high water table — only a few feet below grade. Waterproofing the tunnels would therefore have been a problem and this made the cost of tunnels too high.

Building covered walkways to support this piping would also have been very expensive. Many problems of anchoring pipe, crossing streets above grade, and routing pipes into buildings from overhead supports finally resulted in the abandonment of this method.

For economy, the decision was made to lay the pipes in the ground but to take all precautions to insure that the piping and insulation would be as free as possible from present and future defects.

Piping for chilled water and steam is black steel. For the condensate, black wrought iron was used. Piping 2½ in. and larger was welded; smaller was screwed.

Insulation had to be selected that would withstand moisture and other soil conditions. Because of its stability, resistance to chemical action, and the fact that destruction of the vapor barrier at one point would not permit moisture to permeate it for any appreciable time, foamed glass was chosen for the chilled water lines.

A 2 in. thickness of sectional insulation was applied to all chilled water piping. The covering was delivered to the job with a shop-applied layer of glass cloth on the outside of the insulation.

The insulation was applied to the pipe, all joints sealed with a vaporproof mastic and wired in place and the lap on the outside layer sealed. Over the entire surface of the covering a thick layer of vaporproof mastic was spread by hand and a second layer of glass cloth was placed in the mastic. A finish layer of mastic was then spread by hand over the second coating.

It was felt that this vaporproofing on the outside of the insulation would provide an effective vapor barrier. However, there was a possibility that this vapor seal might be broken during erection, or after backfill was in place. Therefore it was decided that the steel pipe should be provided with further protection.

All straight lengths of chilled water piping installed underground were coated with a hot application of semi-plasticised enamel, glass cloth, another layer of enamel, a layer of glass cloth, another layer of enamel, a layer of asbestos felt, and a layer of kraft paper.

All joints and fittings in such pipe were coated and wrapped with tape. This coating protects the pipe from moisture in case the vaporproofing over the insulation should be broken.

For the steam and condensate lines, it was decided that an economical method of insulation for the degree required was by the use of asphaltite poured into the trench so as to cover the steam and condensate lines together. There was no moisture barrier needed for the steam lines, and by making the trench wide enough, ample insulating value could be attained.

In installing the piping, about 300 ft of trench was dug at a time. After the trench was excavated, the anchors were placed, a sand bottom installed, and piping laid and welded. After testing, the joints of the chilled water piping were then wrapped with tape and the lines insulated. After this was complete, the trench was back-filled. During this work, pumps were used to keep the trenches dry.

Provide Expansion, Contraction

A problem which received careful consideration was the matter of expansion bends to permit expansion and contraction of the steam and condensate lines. Bends were carefully located and were formed by the "hot" method to close specifications.

This method employs the use of sand to fill the pipe, after which the pipe is heated in a controlled furnace, then drawn from the furnace and bent around suitable forms while its temperature is still high. The bend is allowed to cool slowly before the sand is removed and the inside of the bend cleaned. Deformations such as flattening, thinning, and the like are thus held to a minimum.

The chilled water piping system was arranged so that no expansion joints were required. This was accomplished by limiting the length of straight runs of pipe and then allowing expansion to take place where the direction of the line changed.

In order to allow space for the underground pipe to move at these offsets, oversized foamed glass insulation was installed at these sections in such a manner that the pipe could move inside the covering.

Drip traps are at low points in the steam system. Wherever possible, these were placed in accessible locations under buildings or in equipment rooms. However, in some cases this was not feasible and it was necessary to mount the traps above ground. At these points, concrete benches were provided to cover the traps. The benches have removable panels for gaining access.

Meet Underground Obstructions

As Tulane has occupied its present site for many years, it was realized that there would be many existing underground pipes, conduits, cables, and other would-be obstructions. Locations of most of these were known from records. However, it was inevitable that certain uncharted lines would turn up. Provisions were made in the mechanical and electrical contracts giving a basis for removing any unused lines and rerouting any lines still in use.

Most of the underground work was done during the summer, when interference with school activities was at a minimum. The work which had to be done in the fall and winter was so arranged as to minimize inconvenience to personnel.

The underground piping and the central plant were designed by Leo S. Weil & Walter B. Moses, consulting engineers. Underground piping was installed by Emile M. Babst Co. Comfortair Co., Inc. was mechanical (heating, piping, and air conditioning) contractor for the central plant. ≠

WINTER SUPPLY UNIT (top, right) was too high off floor to deliver heated air to employees below. Also, poor maintenance because of inaccessibility let filters clog to reduce air quantity. Later design has unit heaters no more than 20 ft above floor level

Design 'Around' Production Equipment To Heat High Level Industrial Plants

Production equipment must not block air flow; unit heaters must be accessible for maintenance

BY JOHN VONDERHEIDE
Manager, Plant Engineering
Appliance Park
General Electric Co.

● **The experience gained in heating General Electric's Appliance Park, Louisville, gives rise to some sound rules of thumb for designing heating systems for high level industrial buildings equipped with complex production equipment. What problems were faced and how they were solved are described here.**

Mr. Vonderheide, a registered professional engineer, has 25 years' experience in mechanical engineering. His background includes heating, ventilating, and air conditioning contracting; sales and application engineering management in the hydraulics field; supervision of design and construction of industrial facilities; and plant engineering management. In 1951 he became associated with General Electric Co. in his present capacity.

GENERAL ELECTRIC CO.'s Appliance Park, Louisville, comprises six large manufacturing buildings, plus large warehouse and service buildings, totaling well over 5 million sq ft of work space. Major buildings are of steel frame, single-story, high level design with clearance elevations ranging from 20 to 46 ft.

The experience and design progress, as related by the Park plant engineers, can well provide important guidance information for those responsible for designing heating systems for new facilities to be constructed or for engineers involved with major rearrangement situations.

Appliance Park represents a truly unusual industrial development for quite a number of reasons. For example, the original concept involved a number of individual large manufacturing plants located on the same site but wholly decentralized insofar as individual requirements and activities are concerned.

Standardization of like facilities was implemented as being desirable and economical, but each major plant building was really designed around the product need. Long-range vision was needed on the part of design engineers, because the construction program alone was planned to require five years or more. Many new type product facilities and large-scale mechanization installations were included in the program, as well as flexibility for further growth.

Although many conventional design features were used, plant layouts were such that innovations became a necessity to keep pace with product department planning: secondary distribution of electric power was eliminated to a major extent; a storm sewer water collection system includes capture of rain for re-use and conservation purposes (as was described in the December 1958 issue); extensive landscaping assists in air pollution control. These are just a few of the plant operations which were designed in unique manner. While the end result will be a monument to industrial progress, the problems encountered were many, and review for potential benefit to other industries seems important.

Conventional Design Fell Short

When this "industrial community" was conceived, engineers used conventional heating system design criteria for these buildings. But as construction progressed and problems were encountered, the heating equipment installation changed to a major extent.

With a total building heat loss of about 400 million Btu per hr, plus process outdoor air makeup of nearly 6 million cfm (tempered to 70 F discharge for winter cycle), the heating plant steam load represents just about 50 percent of the total design capacity for the boilers.

This steam generating plant, with five 150,000 lb per hr coal fired boilers, supplies all the buildings via an overhead steam distribution system (200 psi for process and 30 psi for heating). The result is a satisfactory and economical installation.

The only disappointment with the steam distribution system involved the condensate return. The system was based on a condensate recovery of 70 percent. However, operating experience indicates that this will be difficult without additional modification of the return system.

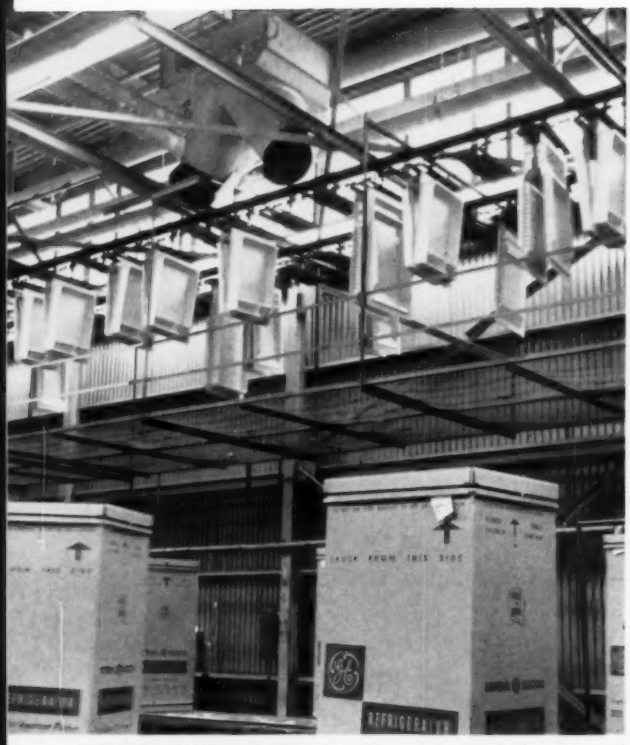
For several of the earlier buildings pressurized return was used, with steam actuated pickup stations to discharge into the high pressure return main. This arrangement was found to be unsatisfactory from the standpoint of wide temperature differentials in condensate and resultant damage potential to the pipelines, plus awkwardness in flexibility needed.

Several later buildings were designed with condensate pickup stations and pumps which operated at atmospheric pressure. This offered tremendous improvement. The practical aspects of changing the entire return system to the atmospheric pressure type are now being studied, and it is believed that this will correct all existing difficulties.

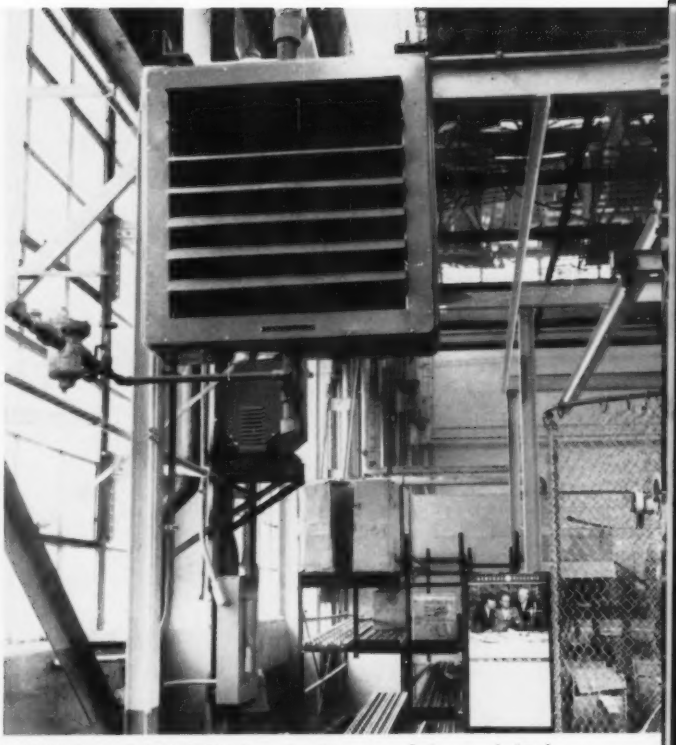
Air Delivery Blocked

The most interesting heating problems were presented when the high level factory buildings were equipped with production facilities. Initial construction had included the necessary steam recirculating unit heaters to supply normal heat loss, plus the required number of winter outdoor air makeup heaters. This equipment was installed throughout the buildings for best distribution of heated air. The unit heaters, generally, were of 1 million Btu per hr capacity, and the outdoor air makeup units were installed in the 20,000 cfm capacity size and located just above the truss line.

When the buildings were equipped with conveyor systems, from 5 to 30



TYPICAL UNIT HEATER in old arrangement had to contend with air distribution obstructions like this



PERIMETER LOCATED, low level mounted heater helped solve air distribution problem

miles per building, and other major process facilities such as paint systems, pickling, anodizing, metal press stations, etc., the originally installed heating equipment was almost entirely blocked off insofar as air delivery to the floor was concerned.

Maintenance of equipment was awkward and costly. Numerous equipment relocations, duct additions, etc., were required. Air stratification, due to the high level building design, presented real problems with temperature variations from 65 F at floor level to 120 F above the truss line when the outside temperature was near freezing. Process heat gain also played a big part in building temperature problems. Unit heaters located in bays away from the outside walls were found to be of little value.

Factory building areas had ventilating facilities which provided for a positive pressure condition to minimize infiltration. Poor maintenance because of equipment inaccessibility soon took a serious toll in air quantity due to dirty filters and mechanical troubles. It soon become obvious that the plan would be ineffective if these conditions remained.

Design ideas were changed. Recirculating unit heaters were located as near the outside walls as possible, and installed so that air movement was in a predetermined direction to circulate around the perimeter of the space to be heated.

With the exception of a few down-blow fans, which were installed to help minimize stratification, no unit heaters were located in the inside bays.

The outdoor air makeup units, instead of being 20,000 cfm capacity and installed above the truss line, were consolidated into large systems of 100,000 cfm capacity and installed in roof penthouses.

Near the walls, unit heaters could be installed about 20 ft above the floor, below any obstruction, and the large volume outdoor air makeup units were much easier to control.

With this arrangement, comfort troubles just about disappeared, no increased initial cost was incurred, and the desired flexibility needed was regained. This, of course, also reflects tremendous dollar savings.

Based on the experience gained in heating these buildings, there is no doubt but that all high level plant heating and ventilating requirements revolve around an elevation of not more than 20 ft above the work floor — the exception, of course, being the exhausting of stale air through the roof.

To be most effective, recirculating unit heaters should always be installed adjacent to outside walls and at a height not to exceed 20 ft. Where specific ventilation is required and where moving equipment is involved, comfort conditions can be improved if the supply air is heated and distributed directly into the occupied area.

Base Design on Empty Building

Basic heating systems for new buildings should be installed with an empty building as a design criterion. Compensation for heat loss or gain by reason of process should be made entirely with tempered air ventilating equipment (winter cycle type). When these factors are used, the result will be attractive initial cost, low maintenance cost, maximum employee comfort, and facilities flexibility which is always of great economic importance when production layouts are changed. ⧺

tricks and trends

LESTER T. AVERY, author of this feature, is president of Avery Engineering Co., Cleveland mechanical contractor, and a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors. On this page, which appears regularly, he reflects on his installation experiences.

Who Wants a Frosted Coil?

FROST on air cooling coils can start a lot of trouble. Excessive frost can build up to reduce air flow and can even accumulate to the degree that the coil is stopped-up completely. The result is no air flow and, consequently, no air cooling.

If a machine doesn't have a suction pressure cutout, suction pressure can drop with the accumulation of frost and burn up the compressor. If it has a cutout of the manual reset type, there exists a continuous nuisance problem of restarting whenever the compressor stops on cutout. This arrangement is conventional on package units.

Automatic reset on the suction pressure cutout can short cycle the compressor to its ultimate damage.

Dirty filters are a common problem and are the first thing to look for in case of low-suction trouble. Also, dirty coils are often serious offenders. A cooling and dehumidifying coil collects dirt on its wet surface. In the course of time this will accumulate to a point where the flow of air is restricted due to mud that has caked between the fins. There's no cure for this except to clean the coil properly with a detergent. Dirty air with oil vapor really makes this cleaning a rough problem.

Heating coils should be cleaned also. Although they do not collect mud, they do accumulate dust and frequently are stopped up sufficiently to reduce air flow.

A fan drive will sometimes work loose and slip, thus permitting loss of air and causing the frost problem.

A slight leakage of refrigerant will drop the pressures, both discharge and suction, whereby the coil may operate below freezing. Too low a condensing pressure, due to water or air that is too cold on the air cooled condensers, causes a corresponding drop in suction pressure. This is particularly true on air conditioning jobs used in the wintertime where there is a high heat load and insufficient outside air for cooling.

When you stop to think of it, you see that the manufacturer building the unit or the engineer selecting the coil is designing on a maximum load which means high temperature air coming to the coil and a high temperature difference across the coil for cooling and dehumidifying.

On light loads the compressor is larger than the coil. On large compressors an unloader can be used which will keep the suction above freezing temperature. Back pressure valves are sometimes used with certain types of coil and cooling applications.

In general, it seems very important that the compressor be stopped and checked for the trouble source if it is running at suction pressures below the frost line. Where outside air is being used for winter ventilation it may be that an automatic damper will help to hold the quantity of outside air to mix with return air above a set temperature, i. e., 65 F mixed air, below which the compressor is locked out and cooling is provided by outside air only.

Sometimes a preheater can be installed in the outside air intake to temper the air up before it comes into the mixed air chamber. This is particularly desirable on those machines that must be held ready to run and have water cooled condensers in the path of the air stream.

It seems the literature has been a little bit too quiet on this subject.

Many machines have been ruined and service problems created by low suction pressure.

For comfort cooling, coil temperature must be kept low enough to dehumidify, but not low enough to form frost. If frost or low suction pressure exists, steps must be taken to protect the compressor and to make the system operate automatically.

If automatic control is to function under all weather conditions at all times of the year, very special and careful planning is required. Only by analyzing the problem ahead of time and providing the necessary interlocks and safety devices, can you be sure of a safely functioning job under all conditions. ∔

Wrought Iron, Wrought Steel Piping Standard Is 20 Years Old this Month

ASA B36.10 has been indispensable to consulting engineers and piping contractors for a score of years. How familiar are you with this valuable design and installation tool?

BY H. H. GEORGE
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Product Engineering and Research Dept.
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On April 28, ASA B36.10, Wrought Iron and Wrought Steel Pipe, will observe its 20th birthday. In the past two decades its schedule number system has provided a "meeting of the minds" among designer, installer, user, and supplier regarding pipe wall thicknesses. This article reviews some of the historical highlights that led up to its being established, and presents data on current pipe sizes and wall thicknesses as they are defined by the Standard.

Mr. George was graduated from the University of Pittsburgh with a B.S. degree in physics and engineering in 1935, and received his M.S. in physics from the same institution in 1939. He is responsible for the design of all of Tube Turns's piping components. His principal professional interest lies in the field of metal fatigue and he has written several articles for Heating, Piping & Air Conditioning.

SINCE ITS FOUNDING in 1918, the American Standards Association has issued numerous Standards dealing with the manufacture and use of pipe and piping components. Each represents a forward step in piping design and has contributed in some degree to the advanced state of the industry.

One of the most important of these Standards—ASA B36.10, Wrought Iron and Wrought Steel Pipe—is 20 years old this month. The schedule number system for designating pipe wall thicknesses was introduced in this Standard and has become an almost indispensable tool of piping engineers, contractors, and users.

Unfortunately, too few people are familiar with the derivation of the schedule number system or with the differences between the dimensions for schedule wall pipe and those for the more traditional weights: "standard," "extra strong," and "double extra strong." Therefore a short review of B36.10 might be appropriate at this time. This should be of particular interest to the new generation of engineers and contractors who have joined the industry in recent years.

Lack of Standards Caused Confusion

When pipe first became commercially available in this country, it was most frequently employed for waterworks service. Its users were primarily concerned with hydraulic considerations, giving only perfunctory notice to mechanical characteristics. When 2 in. or 10 in. pipe was referred to, 2 in. ID or 10 in. ID was meant. Therefore pipe

was made to meet nominal inside diameter dimensions and the outside diameter was determined by the wall thickness required for a specified application. At that time, tolerances were relatively loose, being governed principally by manufacturing limitations, and the outside diameter of pipe made to the same nominal size was likely to vary from mill to mill.

Since threaded connections offered the only suitable means of joining pipe, each wall thickness required a different threading on the coupling and other screwed components to be used with the pipe. Consequently, in buying material for a complete layout, the user first had to determine the dimensions of the pipe to be delivered, and then have the valves, couplings, and fittings threaded accordingly. The procurement delays and general confusion can easily be imagined.

The first rational approach toward a remedy for this situation came in 1882 when Robert Briggs, then superintendent of Pascal Iron Works, Philadelphia, formulated nominal dimensions of pipe and pipe threads up to and including 10 in. based on thread forms he had initiated 20 years earlier. These dimensions were widely accepted by the piping industry and were known informally as the "Briggs System."

During a series of conferences, committees representing the American Society of Mechanical Engineers, manufacturers, and pipe users calculated additional sizes and tabulated details of the standard more completely than had been done originally by Mr. Briggs. In 1919, this standard was approved by the American Engineering Standards Committee (now the ASA) and published as American Standard A.E.S.C. No. 3—1919.

The original Briggs formula determined the outside diameter of the standard pipe thread and thereby the nominal OD of the pipe itself. It consequently became a basis for the later evolution of the Iron Pipe Size (IPS) system of designating pipe sizes by outside diameters.

Under the IPS system, outside diameter dimensions were arrived at by adding to the nominal inside diameter twice the thickness of the skelp used in making the pipe, and rounding the result to the nearest 1/16 in. Investigate standard weight pipe and you will find that the nominal inside diameter is just about equal to the nominal pipe size. You will also find that outside diameters of pipe 2 in. and larger are some multiple of 1/16 in.

When higher pressures necessitated the manufacture of heavier pipe, IPS outside diameters were retained and wall thicknesses increased. Conversely, when manufacturing and construction processes and techniques were improved and thinner walls made possible, the inside diameter was increased but the IPS outside diameter remained constant.

As the American Standard (Briggs) pipe thread and the IPS system became universally popular, it became possible to buy pipe from a mill in Pennsylvania and fittings from a Kentucky distributor and have the two match. This brought a degree of order to the industry. Nevertheless, when ASA Sectional Committee B36 was organized in 1927 for the purpose of unifying existing practices and standards on pipe wall thicknesses, it faced a monumental task.

Changing Conditions Limited Usefulness

Industry generally had come to identify pipe weights as "standard," "extra strong," and "double extra strong." These designations were firmly entrenched in piping terminology. Upon these dimensions an enormous, successful industry had been built—embracing huge capital investments in manufacturing plants, equipment, and processes.

It was universally recognized, however, that these standards contained serious limitations. None of the existing classes, for example, would uniformly fit a given set of service conditions throughout the complete size range. In choosing pipe of varying outside diameters it became necessary for the designer to switch from one wall thickness to another, or even order a special weight for an essentially routine piping installation.

Frequent confusion resulted from the presence of more than one wall thickness for pipe of the same size within a single series. For instance, 8 in. standard weight pipe was available with 0.277 and 0.322 in. walls, 10 in. pipe came with 0.279, 0.307, and 0.365 in. walls, and 12 in. pipe had 0.330 and 0.375 in. walls.

Before 1927, these defects had not been of great importance since service conditions normally encountered in industrial piping of that era were relatively mild. The rapidly developing trends toward higher operating temperatures and pressures, however, clearly indicated the immediate need for drastic changes and improvements.

Additional series of standardized outside diameters and wall thicknesses were obviously required to meet needs for greater strength and versatility in piping. These dimensions had to be based on a rational system related to expected operating conditions. Ideally, there should also be provisions enabling a more direct application of the various safety codes for relating commercial wall thickness to service requirements. It was generally agreed, too, that the entire industry would benefit if infrequently ordered pipe sizes were eliminated from the lists, i.e., 11½, 7, 9, 11, 15, and 22 in., which added little to overall design and efficiency but much to manufacturers' and distributors' costs.

In 1928 came the almost simultaneous introduction of the shielded metallic arc electrode and the seamless butt-welding fitting which permitted the art of welding to be utilized in the fabrication of piping systems. These eventually were to lead to considerable savings in material, erection, and maintenance costs.

The problem became, then, not one of unifying existing standards, but of writing a new one—of abandoning a carryover from the horse and buggy days of 125 psi operations and replacing it with suggested regulations more in line with changed conditions. To say the Committee's solution was an outstanding success is a patent understatement. With only minor modifications, the original specification had been used successfully for two

decades of rapid—and at times almost revolutionary—technological advancement.

Schedule Numbers Give Logical Answer

Essentially, the Committee's goal was the establishment of wall thicknesses reasonably in accord with the usual "basis of design" formulas and uniformly suited to the same service conditions throughout a complete pipe size range.

To this purpose, the schedule number system of logically progressive thicknesses based on pressure stress ratios was originated. A factor of 1000 was introduced for convenience in order that the results would be whole number expressions, viz:

1000 × (internal pressure/allowable stress), or $1000 \times P/S$

It should be noted that two distinct advantages result from the use of this dimensionless parameter. First, the P/S ratio applies equally well to any system of measurement. Secondly, by basing the thickness schedules on P/S values, the three design variables (operating temperature, operating pressure, and piping material) are taken into account in the single ratio.

As a means of providing a reasonable relationship with the accepted basis of design, the Committee developed the following modification of the Barlow formula (then used in the ASME Boiler Code):

$$t = (P/S)\ (D/1.75) + 0.1$$

where:

P = internal pressure, psi
S = allowable fiber stress at operating temperature, psi
D = outside diameter of pipe, in.
t = wall thickness, in.

(The substitution of the factor 1.75 for the factor 2 used in the original Barlow formula makes allowance for the 12½ percent mill tolerance permitted in pipe manufacture. Note also that the corrosion allowance is rounded out to 0.1 inch.)

Thus, the schedule number system indicates the operating conditions for which pipe of a specified wall thickness is suitable. For Grade A seamless carbon steel pipe with an average allowable stress of 12,000 psi, the maximum allowable working pressure is determined by multiplying the schedule number by 10. Therefore Schedule 40 Grade A seamless pipe may be employed for service pressures of around 480 psi.

Relate Schedule Numbers to Weights

In an effort to gain ready, wide acceptance for the proposed new standards, the Committee incorporated existing pipe weights in schedules insofar as this was practicable. It found that for pipe sizes up to 12 in., industry usage largely centered around four series of thicknesses which could be expressed as four schedules: Schedules 40, 80, 120, and 160. Therefore many of the "standard" dimensions were used for Schedule 40 and much of the "extra strong" list was incorporated as Schedule 80. Wall thicknesses from current practice were selected for intermediate series equalling Schedules 60, 100, and 140. Three additional series, designated as Schedules 10, 20, and 30, were set up to meet the demand for pipe to be used in lower pressure service. "Double extra strong" thicknesses were too erratic to fit in with any schedule system where allowable pressure had to be uniform throughout the size range and a separate Schedule 160 was evolved.

In November 1935, the ASA approved the proposed schedules which were published as an American Tentative Standard. After subsequent minor revisions, the schedule system was accorded full American Standard status on April 28, 1939.

Acceptance of New Standard Spotty

For those service conditions where computation of pipe wall thickness by code formula was an economic necessity, as in the steam power, oil refining, and chemical industries, acceptance of the schedule system was a foregone conclusion. Elsewhere in the industry, however, acceptance was spotty, and demand and production of pipe to the traditional dimensions was undiminished. Consequently, additional specifications covering accepted dimensions and weights for commercial pipe were included in later editions of the Standard.

And there's the rub!

Presence of both the traditional thicknesses and the schedule dimensions has given rise to confusion. In sizes through 10 in., wall thicknesses for "standard" and Schedule 40 pipe are the same. Beginning with 12 in. diam, however, wall thickness for Schedule 40 pipe increases in line with the P/S pattern, while the wall of "standard" weight remains a constant 0.375 in. A similar situation exists in comparing "extra strong" and Schedule 80 pipe where the break point is 10 in. diam. and above that size "extra strong" thickness is a constant 0.500 in.

Consider a typical order for pipe and fittings calling for shipment of 2, 6, 10, 14, and 20 in. sizes, all in "standard" weight. Is the supplier safe in assuming that "standard" weight provides the correct wall thickness, or has there been a clerical error and Schedule 40 thickness is actually desired in the larger sizes? Unfortunately, these are not merely rhetorical questions. Too frequently, valuable time is lost in resolving the problem.

Increasing familiarity with the Standard has produced a decline in difficulties of this nature, but the inherent inconsistency remains and the possibility of mistakes continues.

Stainless Standards Inconsistent, Too

A similar source of confusion exists in American Standard B36.19 which covers corrosion resistant pipe. Here the difficulties initially center around Schedules 80 and 80S in that the 12 in. Schedule 80S is the same thickness as "extra strong" rather than being the same as Schedule 80. In the 14 in. size, Schedule 10S calls for 0.188 in. wall, while Schedule 10 specifies 0.250 in. thickness from 14 through 24 in. Too frequently, these variations result

TABLE 1—PIPE SIZES, WALL THICKNESSES currently established as standard are listed below. Specifically, these are: traditional "standard," "extra strong," and "double extra strong" weight pipe; pipe wall thickness schedules listed in ASA B36.10 which are applicable to carbon steel and alloys *other than* stainless steels; and pipe wall thickness schedules listed in B36.19 and ASTM Specification A409 which are applicable *only* to corrosion resistant materials. (Note: Schedule 10S is also available in carbon steel in sizes 12 in. and smaller)

NOMINAL PIPE SIZE	OUTSIDE DIAM.	NOMINAL WALL THICKNESS FOR														
		SCHED. 5S*	SCHED. 10S*	SCHED. 10	SCHED. 20	SCHED. 30	STANDARD†	SCHED. 40	SCHED. 60	EXTRA STRONG‡	SCHED. 80	SCHED. 100	SCHED. 120	SCHED. 140	SCHED. 160	XX STRONG
⅛	0.405	.....	0.049	.....	.....	.....	*0.068*	0.068	.....	*0.095*	0.095	.....	.....	.....	.....	.....
¼	0.540	.....	0.065	.....	.....	.....	*0.088*	0.088	.....	*0.119*	0.119	.....	.....	.....	.....	.....
⅜	0.675	.....	0.065	.....	.....	.....	*0.091*	0.091	.....	*0.126*	0.126	.....	.....	.....	.....	.....
½	0.840	.....	0.083	.....	.....	.....	*0.109*	0.109	.....	*0.147*	0.147	.....	.....	.....	0.187	0.294
¾	1.050	0.065	0.083	.....	.....	.....	*0.113*	0.113	.....	*0.154*	0.154	.....	.....	.....	0.218	0.308
1	1.315	0.065	0.109	.....	.....	.....	*0.133*	0.133	.....	*0.179*	0.179	.....	.....	.....	0.250	0.358
1¼	1.660	0.065	0.109	.....	.....	.....	*0.140*	0.140	.....	*0.191*	0.191	.....	.....	.....	0.250	0.382
1½	1.900	0.065	0.109	.....	.....	.....	*0.145*	0.145	.....	*0 200*	0.200	.....	.....	.....	0.281	0.400
2	2.375	0.065	0.109	.....	.....	.....	*0.154*	0.154	.....	*0.218*	0.218	.....	.....	.....	0.343	0.436
2½	2.875	0.083	0.120	.....	.....	.....	*0.203*	0.203	.....	*0.276*	0.276	.....	.....	.....	0.375	0.552
3	3.5	0.083	0.120	.....	.....	.....	*0.216*	0.216	.....	*0.300*	0.300	.....	.....	.....	0.438	0.600
3½	4.0	0.083	0.120	.....	.....	.....	*0.226*	0.226	.....	*0.318*	0.318	.....	.....	.....	.....	.....
4	4.5	0.083	0.120	.....	.....	.....	*0.237*	0.237	.....	*0.337*	0.337	.....	0.438	.....	0.531	0.674
5	5.563	0.109	0.134	.....	.....	.....	*0.258*	0.258	.....	*0.375*	0.375	.....	0.500	.....	0.625	0.750
6	6.625	0.109	0.134	.....	.....	.....	*0.280*	0.280	.....	*0.432*	0.432	.....	0.562	.....	0.718	0.864
8	8.625	0.109	0.148	.....	0.250	0.277	*0.322*	0.322	0.406	*0.500*	0.500	0.593	0.718	0.812	0.906	0.875
10	10.75	0.134	0.165	.....	0.250	0.307	*0.365*	0.365	0.500	*0.500*	0.593	0.718	0.843	1.000	1.125	.....
12	12.75	0.156	0.180	.....	0.250	0.330	*0.375*	0.406	0.562	*0.500*	0.687	0.843	1.000	1.125	1.312	.....
14 O.D.	14.0	0.156	0.188	0.250	0.312	0.375	0.375	0.438	0.593	0.500	0.750	0.937	1.093	1.250	1.406	.....
16 O.D.	16.0	0.165	0.188	0.250	0.312	0.375	0.375	0.500	0.656	0.500	0.843	1.031	1.218	1.438	1.593	.....
18 O.D.	18.0	0.165	0.188	0.250	0.312	0.438	0.375	0.562	0.750	0.500	0.937	1.156	1.375	1.562	1.781	.....
20 O.D.	20.0	0.188	0.218	0.250	0.375	0.500	0.375	0.593	0.812	0.500	1.031	1.281	1.500	1.750	1.968	.....
22 O.D.	22.0	0.188	0.218	0.250	.....	.....	0.375	.....	.....	0.500	.....	.....	.....	.....	.....	.....
24 O.D.	24.0	0.218	0.250	0.250	0.375	0.562	0.375	0.687	0.968	0.500	1.218	1.531	1.812	2.062	2.343	....
26 O.D.	26.0	.....	.....	.....	.....	.....	0.375	.....	.....	0.500	.....	.....	.....	.....	.....	.....
28 O.D.	28.0	.....	.....	.....	.....	.....	0.375	.....	.....	0.500	.....	.....	.....	.....	.....	.....
30 O.D.	30.0	0.250	0.312	0.312	0.500	0.625	0.375	.....	.....	0.500	.....	.....	.....	.....	.....	.....
32 O.D.	32.0	.....	.....	.....	.....	.....	0.375	.....	.....	0.500	.....	.....	.....	.....	.....	.....
34 O.D.	34.0	.....	.....	.....	.....	.....	0.375	.....	.....	0.500	.....	.....	.....	.....	.....	.....
36 O.D.	36.0	.....	.....	.....	.....	.....	0.375	.....	.....	0.500	.....	.....	.....	.....	.....	.....
42 O.D.	42.0	.....	.....	.....	.....	.....	0.375	.....	.....	0.500	.....	.....	.....	.....	.....	.....

All dimensions are given in inches.
The decimal thicknesses listed for the respective pipe sizes represent their nominal or average wall dimensions. The actual thicknesses may be as much as 12.5 percent under the nominal thickness because of mill tolerance. Thicknesses shown in light face for Schedule 60 and heavier pipe are not currently supplied by the mills, unless a certain minimum tonnage is ordered.

*Schedules 5S and 10S are available in corrosion resistant materials and Schedule 10S is also available in carbon steel.
†Thicknesses shown in *italics* are available also in stainless steel, under the designation Schedule 40S.
‡Thicknesses shown in *italics* are available also in stainless steel, under the designation Schedule 80S.

in mistakes in shipments and consequent time losses.

Table 1 presents a complete list of the pipe wall thickness dimensions established by the American Standards Association. Values are given both for schedule number pipe and the traditional "standard," "extra strong," and "double extra strong" weights, where applicable.

Reference to this table when specifying wall thickness of pipe or fittings undoubtedly will help eliminate irritating mistakes and speed up procurement and construction.

Change in Standard Proposed

Of considerable current interest is the broadly-based move seeking the establishment of standards for carbon steel pipe in sizes ¾ through 12 in. with wall thicknesses corresponding to Schedule 10S.

Several users report that substantial savings can be realized by employing thin wall material for noncritical installations. It has been estimated that the chemical industry alone can reduce carbon steel piping costs some 10 percent by using lighter than standard wall piping where pressure, temperature, and other conditions permit.

Engineering and purchasing interests alike are attracted to the cost-reducing possibilities afforded by use of this thin wall material. It seems likely that the inclusion of Schedule 10S thickness for carbon steel pipe specifications will be recommended to the ASTM in the near future. ⌗

High Velocity Induction System

IOWA LUTHERAN Hospital's 1913 wing is air conditioned by ceiling-mounted high pressure induction units located in corridor on each floor and ducted into each room

• One of the problems facing a hospital is that people delay going there in hot and humid summer months, preferring to wait until cooler weather. The obvious results are over-crowding and turning-away during the winter and too many vacancies in summer. This is critical, since the patient is the hospital's main source of income. Therefore it is important that occupancy be as near capacity as possible the year 'round. The answer, of course, is air conditioning—to take the load off the winter months. This article discusses the recent air conditioning of the Iowa Lutheran Hospital, Des Moines, an institution built in 1913 and added to in 1951 and in 1957. Recognizing the economic importance of air conditioning, Iowa Lutheran went all the way: summer cooling throughout, plus electrostatic filtration of all supply air. A ceiling mounted high velocity induction system was chosen. Also described are the installation problems and methods used to solve them in air conditioning two existing connected buildings—of vastly different vintage—at the same time.

Mr. Flanagan is a graduate mechanical engineer of Iowa State College and has served in several positions with Carrier Corp. as an air conditioning engineer. He has been associated with Daniel B. Stevenson, Jr., consulting engineer, for about two years as a design engineer.

BY ROBERT W. FLANAGAN
Design Engineer
Daniel B. Stevenson, Jr.
Consulting Engineer

A CEILING-MOUNTED high velocity induction system provides summer cooling and winter ventilation to air condition existing floors of the Iowa Lutheran Hospital, Des Moines. It has enabled the hospital to keep all rooms in full service the year 'round without loss of revenue.

Individual room control of temperature and humidity is provided. All major equipment is located in the basement, thus making the hospital quieter and saving on equipment room space.

This is the first major hospital in Iowa to be 100 percent air conditioned. The first wing was built in 1913 and consists of five floors, plus

Solves Hospital's Cooling Problems

. . . to provide complete summer air conditioning, and ventilation during the heating season

a basement. In 1922 a nurses' home, a central heating plant, and a laundry facilities building were added. Another wing was completed in 1951 which brought the total bed capacity to 206.

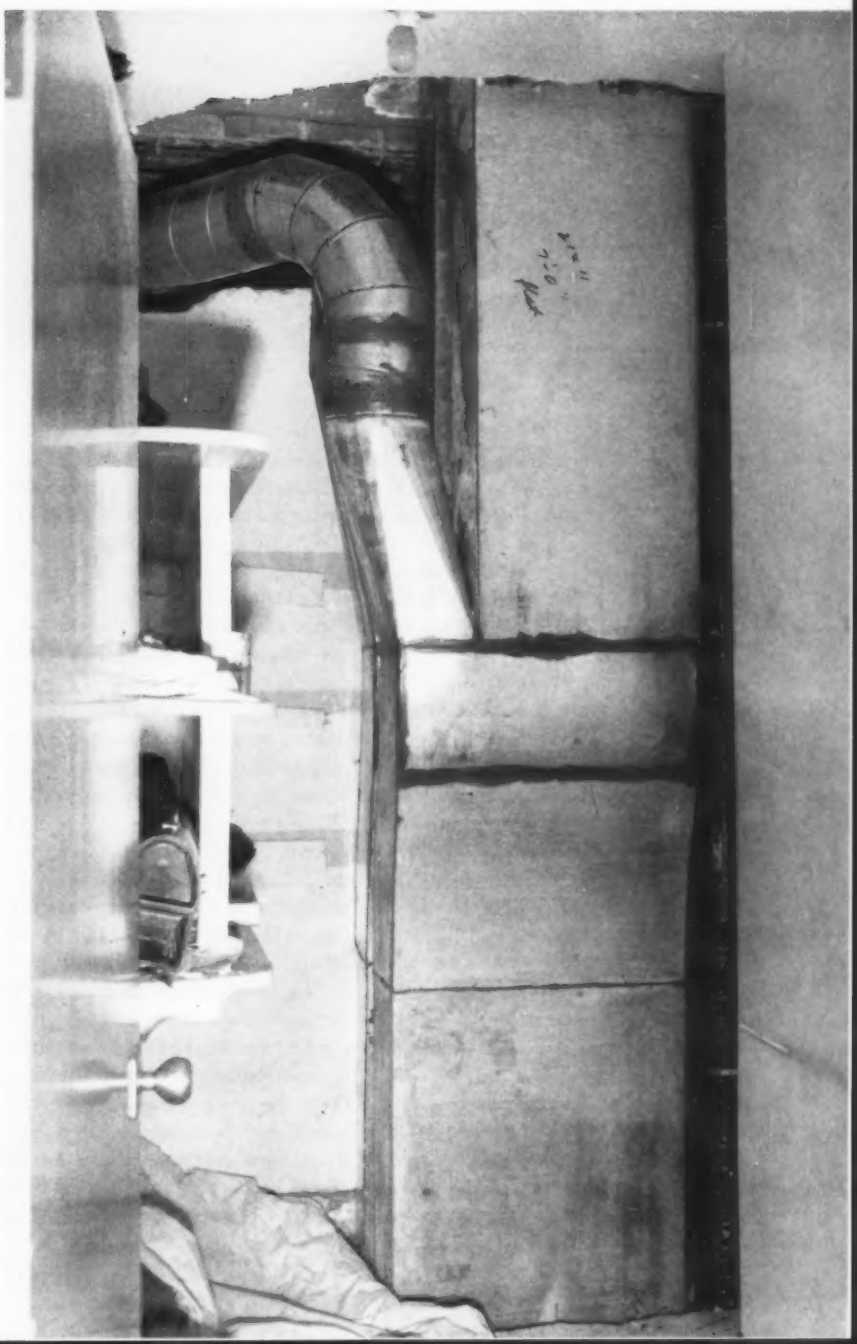
Air conditioning was considered for this new wing but no money was available for such a project at that time. Nevertheless, a duct system was installed above the first floor corridor ceiling to serve the entire first floor. This was a single zone duct with a central return at one end of the corridor, with the supply and return ducts dropping down and capped at the ceiling of the subbasement in the work shop. All supply registers were high sidewall type.

In 1957 two floors and an equipment penthouse were added to the 1951 wing. Also, one floor was added to the 1913 structure. These brought the hospital up to six full floors and a total bed capacity of 250, plus 25 bassinets.

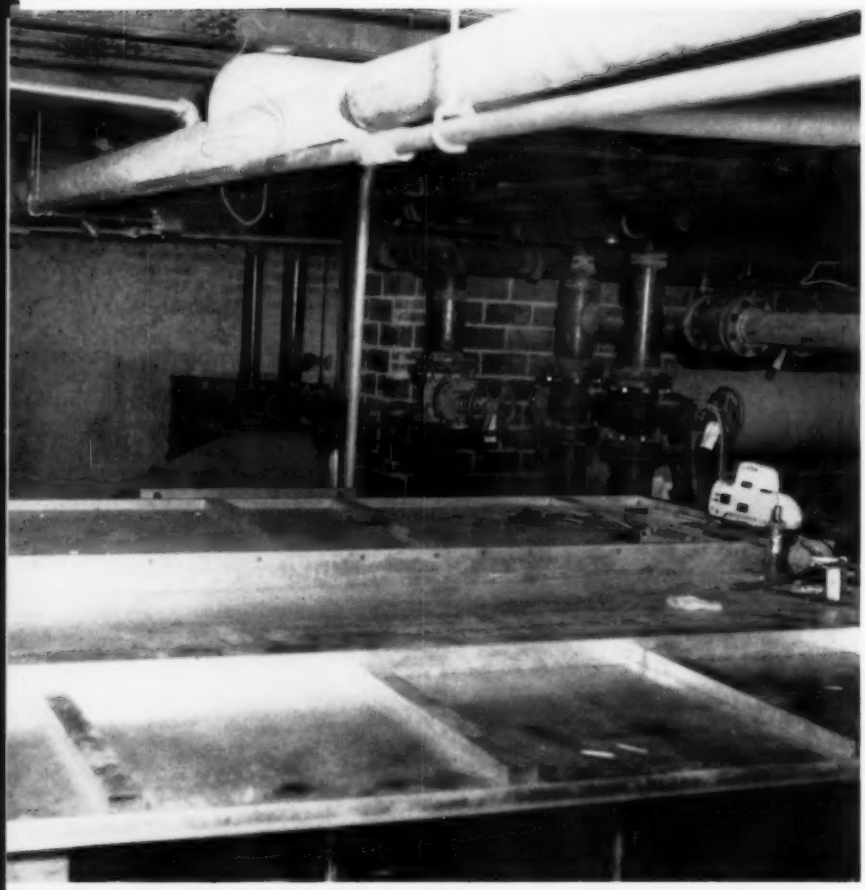
The hospital board asked that these new areas be completely air conditioned. Because of a tight budget, however, no provision was to be made for individual room control.

Two 60 hp reciprocating compressors were installed in the penthouse to supply chilled water to the air handling units, likewise installed there.

As this installation was nearing



WELDED rectangular air risers take off at each floor for each wing. Note welded access panel which was used to weld inside surface of back side and right side of duct



BASEMENT equipment room houses primary air apparatus. Supply header at far end goes through hole in thick concrete footing of 1913 wing

completion, funds became available which permitted planning for air conditioning all remaining areas of the 1913 and 1951 wings and the fourth floor of the nurses' home containing the obstetrics ward.

So, early in 1958, contracts were let to air condition these areas and to add electrostatic filters to all of the penthouse units serving the 1957 addition.

Select High Velocity System

A system of air handling units on each floor and in each wing was considered as a possibility, but this would require one room per wing per floor for equipment, and the loss in revenue became an obstacle.

Even if this compromise were made, an all-air 100 percent outdoor air system would penalize the refrigeration system. Also, the existing exhaust systems could not remove the large amount of outside air brought in. Too, if a return air system were installed, the ceiling space would become a problem since the corridor ceilings are furred down to a height of 8 ft.

All of these problems were resolved into a decision that some form of a high velocity air system should be used in conjunction with a chilled water system.

An ideal system for a hospital is one where: (1) each room has its own temperature control, (2) minimum maintenance work is required in the room, (3) system operation is very quiet, (4) continuous summer-winter humidity control is provided, (5) the system is able to respond to visiting hour loads without upsetting the balance of other rooms where no visitors are permitted or none happen to be, and (6) no cross mixing of air between rooms exists.

Compromises on these items are normally dictated by first costs. However, if existing building conditions impose limitations and compromises, then the design engineer and hospital board should weigh carefully the decision whether to take a less desirable system or spend more to get a better system. At the same time, this will permit recovery of some of this first cost by keeping valuable floor space in service that would otherwise be needed for multiple equipment rooms.

With all of these things in mind, the high velocity induction system was selected to do the job. The induction units are located either above the new corridor ceiling in the 1913 wing and ducted into each room, or located exposed at the ceiling directly above the entrance to each room in the 1951 wing. Each room has its own thermostatic control.

The basement, sub-basement, and cafeteria is each served by its own single-zone air handling unit. The existing first floor duct system is supplied by an air handling unit located in the sub-basement. The high velocity induction system delivers conditioned air to the second, third, and fourth floors, plus two offices, a pharmacy, and chapel on the first floor of the 1913 wing.

Primary air equipment for the system — along with the 150 ton centrifugal refrigeration machine,

"... all rooms in full service during installation"

chilled water pumps, and cooling tower pumps — is located in the basement of the 1951 building.

An area-way was dug outside of the basement equipment room to permit an outside air intake to be installed for the primary air apparatus and the air handling unit serving the basement.

Filter All Supply Air

All air handling systems have cabinet type electrostatic filters with automatic wash control.

At the time the contract for air conditioning the lower floors was let, contracts for installing electrostatic filters on all the systems in the penthouse were let. This then, brought the hospital up to 100 percent air conditioning and 100 percent electrostatically filtered air.

The electrostatic filters for the 110 ton penthouse system and the 150 ton basement system were taken as extras to the base contract. The 110 ton system, being an all-air conventional system, actually handles slightly more air than the 150 ton system.

Costs of the electrostatic filters were almost identical for the two systems, since the total air quantities are about the same and both require the same number of filters.

The cooling towers are located on the roof of the 1913 building. Analysis of the roof structural strength and loads on the 1913 wing dictated that two 75 ton towers be used rather than one large one. The 1951 wing roof was already loaded with a penthouse and cooling towers for the 110 ton system for the 1957 addition, so this area could not accommodate any additional equipment.

Closets Form Duct Shafts

Linen storage closets at the junction of the 1913 and 1951 corridors were used for duct and pipe shafts. Since these closets were in the 1913 wing, the tile joist floor construction necessitated two separate high velocity risers. This was done instead of cutting and framing each floor to accommodate one large riser. The costs were considerably less, also. Each riser handles one wing.

The 1951 wing has a north-south exposure, while the 1913 wing faces east and west. No attempt was made to zone the air or water. The south zone induction units were selected to do all the sensible cooling with the secondary coil, since the peak is reached in late October, and the primary air at that time would have no sensible cooling capacity.

The high velocity induction system offered other advantages: Since the purpose of the system is straight summer cooling and winter ventilation only, we did not have to provide for summer-winter changeover controls. Each unit is equipped with a straight-through throttling valve controlled by a room thermostat. The secondary chilled water pump has an automatic bypass to handle any changes in water flow.

Even the corridors are equipped with induction units to provide the necessary ventilation air and handle interior loads in these areas. Since this system is always on summer cooling or winter ventilation, there will be secondary coil recooling available for late fall and spring when the primary air is on a full reheat schedule. When on the winter ventilation cycle, all primary air is introduced at approximately 70 F.

Heating System Stays As Is

Radiation heating for the building is on a zone control. No attempt was made to integrate these heating controls with the air conditioning. All conventional air handling units have a dewpoint thermostat controlling the chilled water coil and a room thermostat controlling a reheat coil. Preheat coils are controlled by the thermostat set at 50 F for summer operation and at 70 F for winter.

Of course, the high velocity induction system could have replaced the existing radiation. But this would have cost more. The heating system is doing a good job, so it was decided to leave it alone.

Another significant advantage of installing this system is that all rooms were kept in full service during the installation since all the work occurred primarily in the corridor. Thus, there was no loss of revenue from patients' rooms.

Weld All Vertical Ducts

The vertical high velocity risers — made up from welded rectangular ducts — presented an assembly problem. Space between joists was 11 in. maximum and the duct itself was 11 in. deep. Risers were designed so that each had the same overall pressure drop. All horizontal headers in the corridor ceilings were sized to have equal pressure drops. Thus, each system of risers with its horizontal headers would have approximately the same pressure loss.

Since the back side of the one riser was tight against a wall, it was impossible to weld the back side unless an access hole was cut through the wall. The problem was solved by cutting a large enough access panel in the front side of the duct to permit welding the duct on the inside surface, and then welding the access panel back on the duct.

The system is designed for each room to receive at least 1/3 cfm of ventilation air per sq ft of floor area. This air quantity is just about equal to that dictated by the limits of the maximum air-to-transmission ratio.

To install the secondary chilled water lines and high velocity spiral conduit above the corridor ceiling of the 1951 building, a strip of ceiling 2 ft wide was removed down the center of the corridor.

The consulting engineer was Daniel B. Stevenson, Jr. Wetherell & Harrison was the architect. The air conditioning contractor was Conditioned Air Corp. Wolin Co., Inc. was the heating contractor. ±

Winning the Air Conditioning

Round 4:

It's Actually a Battle Royal

BY ALBERT B. HUBBARD

"AIR CONDITIONED rooms will smell in summer, but not in winter."

This problem, stated boldly, without the numerous qualifications and "quibble" phrases required by engineers, can be blamed on humidity and temperature. Since it deals with these physical effects on odors, it is a natural follow-up to the article on physical properties of odorants in the March issue.

In all cases, exactly the same ventilation and odor sources are presumably present the year 'round. The mechanism of one cause, humidity cycling, goes like this: As humidity rises and falls, surfaces adsorb moisture and return it to room air. The moisture pickup dislodges adsorbed odorants, smelled as waves of odor when a

• Humidity and temperature have definite bearing on air conditioning odors. The problem is greater in summer than in winter, due to natural humidity cycles which cause surfaces to adsorb moisture and return it to room air—bringing with it secondary stale odors. Temperature gradients in walls, since they influence diffusion of odorous vapors out of an enclosed space, are another factor. Cold rooms have higher adsorption rates than adjoining warmer rooms. Consequently, they borrow odor-laden moisture from the uncooled spaces. Likewise, in split level arrangements, cool air settles and overcools lowest portions, causing odor problems. This article is the fourth in a series which has appeared monthly, beginning with the January issue.

The author was a long time member of the ASHAE Technical Advisory Committee on Odors and its chairman during 1956 and '57. He was associated with General Electric Co.'s air conditioning department for many years and has had much experience in the design and installation of air conditioning systems for various types of applications.

Odor Fight

room first becomes damp. Another possibility, at this stage merely conjecture and not supported by experiment, is that adsorbed moisture may dissolve odorants not otherwise prone to adsorb on the surface. In any case, humidity cycling is an adequate overall cause of secondary stale odors.

Summertime provides natural, odor-producing humidity cycles; winter does not. In summer, indoor humidity is high and varies widely; in winter, indoor humidity is low and confined to a narrow range.

In my field experience, I have found odors least noticeable in air conditioned spaces in very hot weather, when the conditioner was most used. But in the mild, changeable weather brought by fall, odors were most likely. The salient difference here is steadiness of indoor humidity.

Odor Sneaks Through Walls

Temperature gradients in walls, because they influence the diffusion of odorous vapors out of an enclosed space, may be equally important in the summer *vs* winter indoor odor picture. Most wall materials are porous or there are openings at joints. Imagine what happens to a vapor in these minute passages. When it enters by diffusion, it adsorbs most readily on the colder surfaces. Or, when disturbed by desorption, the vapor tends to re-adsorb on cold surfaces. The effect in winter is that odors work their way out; in summer they are bottled up near cooler inner surfaces. The possibility deserves careful experimental verification, and, if proven, materials and surface treatments should be rated.

Odor diffusion is similar to moisture travel, familiar to everyone through the vapor barriers erected to prevent its condensation on cold surfaces. To form the analogy, substitute adsorption for condensation.

A third cause has been observed by R. L. Kuehner[1]. He found that in a closed room a steady rate of tobacco smoking resulted in different peak odor levels. The differences were related to indoor-outdoor water vapor pressure differentials. Low odor levels occurred when absolute outdoor humidities were lower than indoor, indicating a greater odor escape rate at these times. Here again, this means that conditions favor odor escape in winter but seal odors in during summer.

Whether you prefer any one or any combination of the three explanations, the trend is clearly to more odors in summer. To eliminate secondary odors, I would suggest air conditioning with independent control of temperature and humidity or with modulated cooling rather than on-off temperature control. While I have had too little chance to confirm this, I would expect less stale odor troubles in these systems.

Coldest Room Has Increased Adsorption Rate

The same phenomena causing summer odors will also cause "coldest room odor" — a problem for the odor investigator if that cold room is air conditioned. To illustrate, recall the stale smell in a closed off, unheated room in your home. Sometimes the odors are recognizable as food or tobacco, but mostly they are nameless. Even though connecting doors are closed most of the time, odors diffuse from one room to another. When adjoining rooms are equal, with respect to odor adsorption, equilibrium is attained. That is, odor interchange does not change the concentration in either room. But if one of the rooms is colder, its surfaces will have an increased adsorption rate. The result will be a net transport of odor into the colder room.

To confirm this, note an increased odor level in the cooler room when it is warmest each day (in late afternoon or when sun shines in), due to desorption caused by higher temperatures.

The summer air conditioning example occurs when only one room of a suite of offices is cooled. The cool room borrows odors from adjoining uncooled space. Stale odors are usually at their peak in early morning, if cooling is turned off overnight. For the odor investigator the situation is potentially troublesome since the man with the cool but stale office is usually the one with the most authority.

In split level arrangements, odor complaints tend to come from the low areas. Cool air settles and overcools the lowest portions. The cooler points borrow odor from everywhere in the higher levels. I recall a second floor office reached by stairs which were closed at the bottom and open at the top into the general office area. The cool air provided by the conditioner located in the office sunk to the bottom of the stairwell. Visitors had to pass through a stagnant smelly area as they ascended the stairs.

The lesson in this article for the air conditioning odor investigator is: Look critically in uncooled or higher spaces for odor sources.

Ventilation, as a possible cure to air conditioning odors, will be discussed next month. ⫩

[1]*Humidity Effects on the Odor Problem*, by R. L. Kuehner, Heating, Piping & Air Conditioning, September 1955, pp. 155-158.

How to Design Refrigerant Piping For Refrigerants 12 and 22

. . . used in direct expansion air conditioning systems with reciprocating compressors

REFRIGERANT PIPING must be designed in accordance with the Code for Pressure Piping (ASA B31.1-1955) and many factors must be considered, said J. R. Chamberlain, manager of product and application engineering, York Div. of Borg-Warner Corp., at the symposium on hydronics at the 65th annual meeting of the American Society of Heating and Air-Conditioning Engineers in Philadelphia recently.

He stated that the various characteristics of the refrigerant must be considered as it flows in both its gaseous and liquid phases.

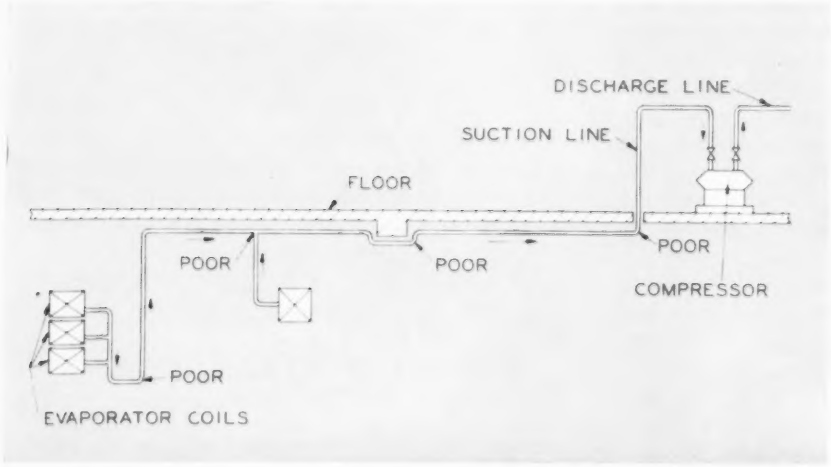
His discussion was limited to refrigerants Nos. 12 and 22 used in direct expansion air conditioning systems with reciprocating compressors.

In the field, many different piping arrangements are possible. The compressor and water cooled condenser usually are close together. However, an evaporative condenser, when used, will ordinarily be remote from the compressor, outside of the building to obtain a source of air. This creates piping complications, he said.

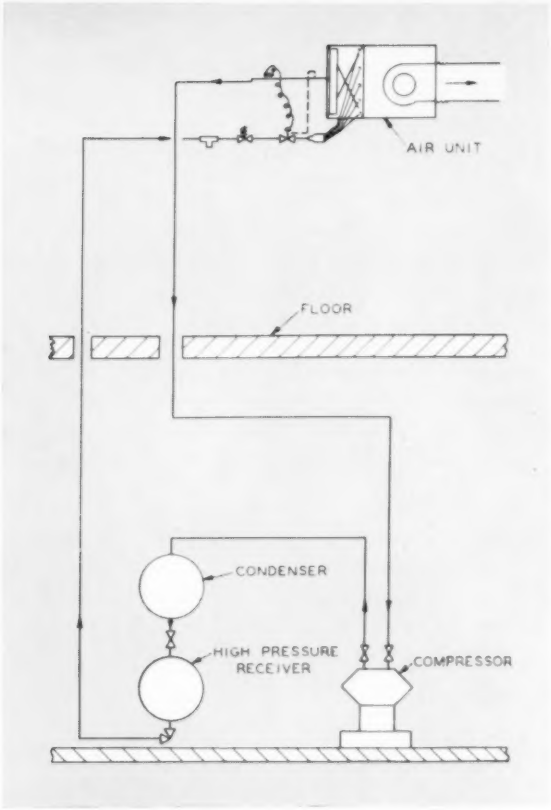
The relation between the compressor and evaporator may be anything that the engineer creates. The evaporator may be elevated above or below the compressor with any variation of length of suction lines, yet the suction line can have a myriad of traps, loops, etc. The necessity of capacity control which involves multiple compressors, each with its own unloading mechanism to first unload, and then stop and start, is important. Yet, there can be a multitude of evaporators controlled by an *on-off* solenoid liquid valve responsive to a room thermostat.

Suction Line Is Worst Offender

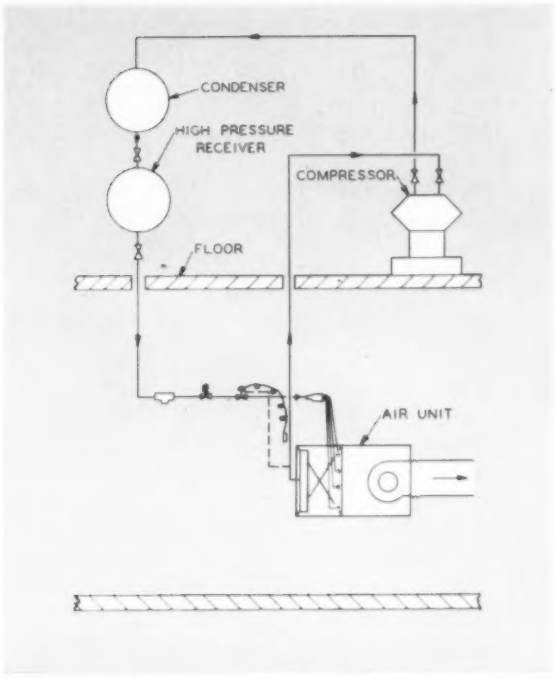
The first problem involved in the design and installation of a field erected direct expansion system is the suction line. This has probably caused more trouble than all other portions of the system combined. The size of this



WHEN EVAPORATOR is at elevation below compressor, suction line should not have loops, traps, or sharp bends which will reduce velocity or increase pressure drop



WHEN DIRECT expansion cooling coil is above high pressure receiver, refrigerant pressure is reduced as it rises upward. Unless refrigerant liquid is subcooled, flash gas formation and improper operation will result



IF COIL is below receiver, flash gas will not form as liquid flows through expansion valve. Combination valve and distributor should be selected with extreme care to avoid oversizing

line depends upon two distinct and opposing factors, he said:

1) Limit the suction line size to minimize first cost and to assure sufficiently high gas velocity to return oil at all load conditions.

2) Keep the suction line size large enough to minimize pressure drop which, if excessive, reduces the system capacity and increases the electrical energy required per unit of cooling.

With opposing influences, compromises must be made — sometimes with disastrous results. If the suction line is oversized to minimize the pressure drop, the operation of the system becomes jeopardized due to insufficient gas velocities which retard the flow of oil from the evaporator to the compressor. Under these conditions, the oil accumulates in the lower portions of the horizontal lines. The compressor can become void of oil and cause nuisance shutdowns even though protected by an oil failure switch. Without this protection, the compressor may fail mechanically.

Another hazard is the accumulation of oil in sufficiently large quantities at some point in a suction line which can return it to the compressor in the form of a slug when the compressor capacity is increased. When the system is idle, any oil lying in the suction line, unless held at low pressure, will absorb refrigerant and this further increases the liquid quantity. On compressor start-up, the high gas velocity will sweep the liquid into the compressor suction.

A refrigeration compressor is designed to handle refrigerant vapors and not large quantities of liquid. Liquid pumping by reciprocating compressors can result in broken valves, pistons, and connecting rods and even wreckage of the housing, he pointed out.

Must Analyze Discharge Line, Too

The discharge line, although not as critical as the suction line, also requires a careful analysis in the system design, Mr. Chamberlain stressed. Again, the choice must be made between operating economy (less pressure drop) and trouble-free operation, or a compromise of these influences.

The suction and discharge lines must also be designed with consideration given to the off cycle when no mechanical cooling is required. Long vapor lines in a colder ambient temperature than in the compressor equipment room, frequently encountered when evaporative condensers are mounted outside, will result in refrigerant condensation in the colder areas. The liquid formed can flow

back to the compressor, causing dilution of the crankcase oil. This crankcase dilution can cause the compressor oil pump to lose its prime when placed in operation. The result is inadequate compressor lubrication. Also, large quantities of liquid lying in an idle compressor cause excessive hydrostatic forces on moving parts of the compressor when it is again brought on the line, causing damage to the machine, he said.

When evaporative condensers and receivers are idle on a roof in the sun and the compressor is in a cooler basement or similar location, migration of liquid to the colder area may fill up a discharge line to the compressor and, should discharge valves leak, even fill up the compressor.

Don't Treat Liquid Lines Lightly

Refrigeration liquid lines are seemingly simple in design, but should not be treated lightly in analyzing the system design. Close coupled refrigeration systems have short liquid lines and are not confronted with problems of large elevation differences. But with remotely located equipment, however, both factors need be considered. Regarding the elevation problem, Mr. Chamberlain reviewed the control device for metering the proper amount of refrigerant to the evaporator coil:

On a direct expansion air cooling coil, a thermostatic expansion valve is applied to control this liquid flow rate and it attempts to provide dry gas to the compressor while the evaporator coil does not become starved. The coil itself contains a considerable length of tubing to provide contact with the air for good heat transfer. A single feed to the coil would involve a long refrigerant circuit with an exorbitant pressure drop. Therefore, instead of a single feed, the coil is designed with a large number of parallel refrigerant feeding circuits. A refrigerant distributor is provided between the expansion valve and the coil to evenly distribute equal amounts of refrigerant to each parallel feed of the coil. To effect equal distribution, pressure drop is absorbed through the many parallel feeds of the distributor.

Since flash gas is formed as the refrigerant expands through the thermal expansion valve, the combination expansion valve and distributor, sometimes a single body, must be sized to pass the full load flash gas and liquid at design conditions. As the evaporator load is reduced, the refrigerant flow falls off proportionately.

However, since the pressure drop through the fixed orifice distributor varies essentially as the square of the velocity, the control and distribution of refrigerant become increasingly difficult for reduced load operation. For this reason, some engineers specify that a combination thermal valve and distributor should not be used for duty where they would be required to operate below 50 percent of their design capacity. Where lower loadings are required, two or more thermal expansion valves, each controlling a coil which is in series air flow, should be used. Each thermal expansion is rendered inoperative by a solenoid valve.

What can happen when the direct expansion cooling coil, and consequently the expansion valve, are located substantially below the high pressure receiver? The ratings of expansion valves and distributors are based on saturated liquid entering the valve. When there is a high static head of liquid above the expansion valve, the refrigerant pressure is higher than the corresponding saturation pressure of the liquid leaving the receiver. Consequently, flash gas will not form as readily as the liquid flows through the expansion valve and the combination valve and distributor will be oversized unless extreme care is taken to select the proper combination for the actual conditions. This phenomenon is readily evident when one analyzes pressure drops resulting from two phase flow with slight changes in percent flash gas. The oversized valve and distributor can, particularly during reduced load operation, result in poor distribution and control with liquid carryover to the compressor likely, he said.

On the other hand, some installations require that the expansion valve and evaporator coil be located at an elevation above the refrigerant high pressure receiver. When the liquid line leaving the receiver rises upward, the refrigerant pressure is reduced due to the lower static head. Unless the refrigerant liquid is subcooled, flash gas formation will be the result.

Increased Flash Gas Increases Pressure Drop

Each increase in the quantity of flash gas further increases the gas and liquid velocity, resulting in a substantial increase in pressure drop above what it would be for saturated liquid. Thus, the mixture of liquid and vapor enters the expansion valve at a pressure below that in the high pressure receiver. Furthermore, the high quantity of flash gas entering the expansion valve will greatly decrease the valve capacity during the full load condition, requiring a rather large valve and distributor combination, according to Mr. Chamberlain.

When the cooling load requirement is less than design, the liquid flow from the receiver will be decreased. This will reduce both the pressure drop and flash gas quantity, making the valve and distributor greatly oversized. Again, poor control and distribution result, with the likelihood of liquid carryover to the compressor.

Many Other Problems, Also

There are numerous other problems involved in the design of a direct expansion system with remotely located evaporators, according to Mr. Chamberlain. The gas lines should be free of traps, often necessitated by interferences. Pitching of the lines is desirable, often a problem with long runs where space above a hung ceiling or in a pipe chase is limited. Noise may be a problem in occupied spaces through which high velocity gas lines pass. Refrigerant lines are more difficult to isolate from vibrating equipment due to higher operating pressures, requiring special treatment of expansion joints or braided connections, if used, he concluded. ≠

New Nomograph Converts Head Into Its Equivalent Pressure

BY F. CAPLAN
Design Engineer
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IT IS often necessary to convert the total head or velocity head of a fluid into the equivalent pressure (and vice versa). This can be done very simply by using the nomograph on the next page. Graphically, it solves the following equations:

$$h = 144\ (P/\rho) \quad \text{.....[1]}$$

where:

h = head of fluid, ft
P = pressure, psi
ρ = fluid density, lb per cu ft.

and

$$V = 1096.5\ \sqrt{(W/\rho)} \quad \text{.....[2]}$$

where:

V = fluid velocity, fpm
W = velocity pressure (pitot tube manometer reading), in. WG.

and

$$h = V^2/2g$$

or

$$V = \sqrt{2\ gh} \quad \text{.....[3]}$$

where:

g = 32.2 fps^2.

One in. WG at 62 F = 0.0361 psi. And, by definition, ρ = reciprocal of specific volume.

In using the nomograph, if a value is beyond the ranges shown, a multiplication or division by 10 or 100 will bring the value into chart range. It follows from the defining equations that if ρ is multiplied by N, then P and W are multiplied by N. If V is multiplied by N, then h, P, and W are multiplied by N^2.

Example 1:

A fluid flow formula gives a friction head of 30 ft. What is the pressure loss if the fluid density is 0.012 lb per cu ft?

Solution: Align h = 30 with ρ = 0.012 and read P = 0.0025 psi. (This solution is plotted on the nomograph.)

Example 2:

A pitot tube manometer gives a reading of 0.2 in. WG. What is the air velocity if the density of the air is 0.075 lb per cu ft?

Solution: Align W = 0.2 with ρ = 0.075 and read V = 29.75 fps = 1787 fpm.

Example 3:

A pump is rated at 20 ft total dynamic head of water (62.4 lb per cu ft). What is the pump head in pounds per square inch?

Solution: Align ρ = (1000) 0.0624 with h = 20 and read P = (1000) 0.00866 = 8.66 psi.

Example 4:

A manometer containing water has a difference in height of 24 in. What is the pressure in pounds per square inch?

Solution: On column A, for W = 0.24 (100), read in column A1, P = 0.00863 (100) = 0.863 psi.

Example 5:

If, in the previous example, alcohol (with a density of 50 lb per cu ft) were substituted for water, what would the differential height be?

Solution: Here, $P_1 = P_2 = h_1\ \rho_1 = h_2\ \rho_2$. Therefore, align ρ_1 = 0.0625 (1000) with h_1 = 2 and read P = 0.000863 (1000); align P = 0.000863 (1000) with ρ_2 = 0.05 (1000) and read h_2 = 2.5 ft, or 30 in.

Example 6:

If 0.075 lb per cu ft air discharges from a stack at 1787 fpm, what is the loss in head?

Solution: Dynamic losses can be expressed as a fraction of the velocity head:

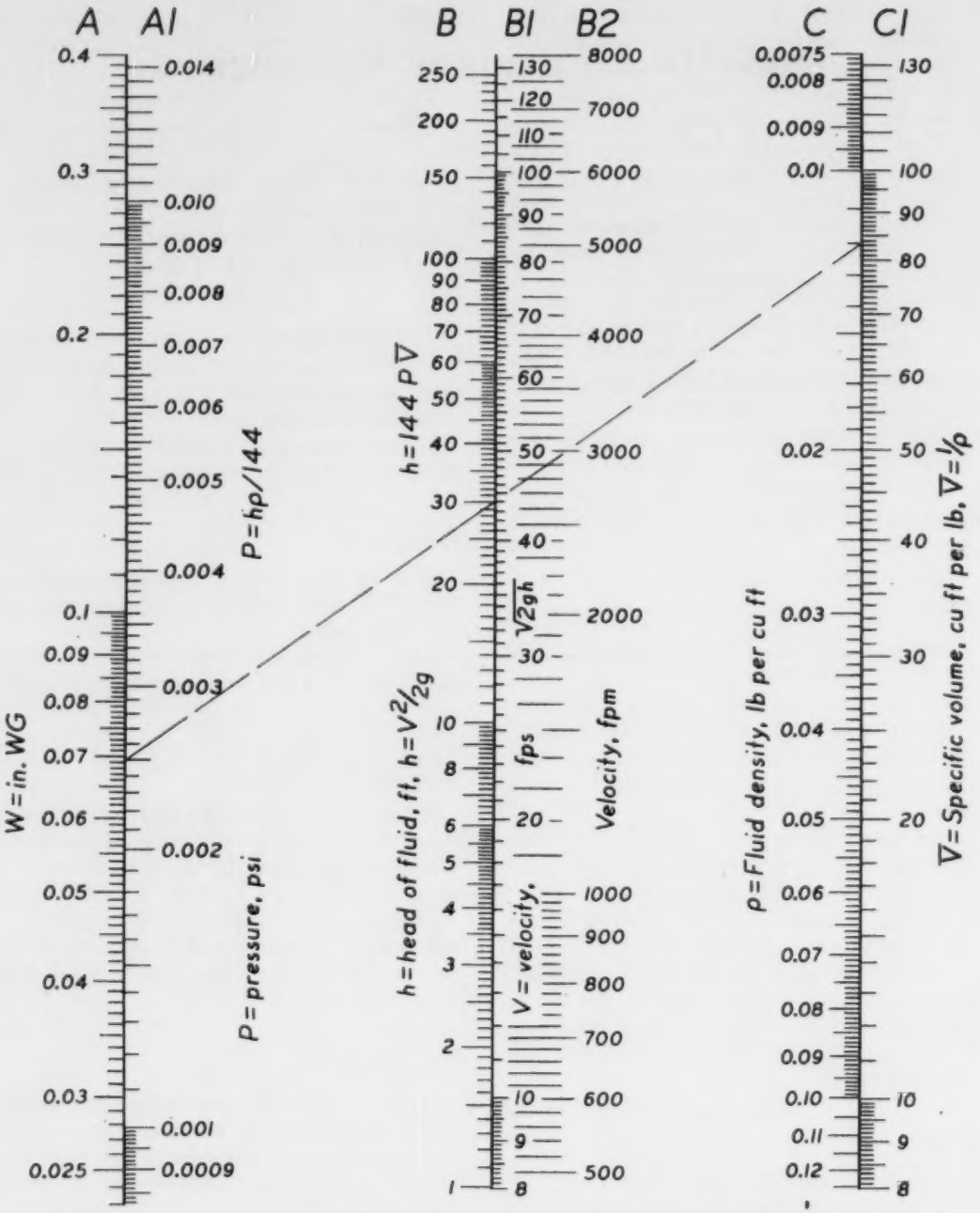
$$H_v = C\ (V^2/2\ g)$$

For discharge to the atmosphere from a pipe, C = 1.0. Therefore, align ρ = 0.075 with V = 1787 fpm and read W = 0.2 in. WG loss in head.

Example 7:

At 155 ft below the surface of an open tank containing water, there is a square edged (K =

HPAC DATA SHEET



NOMOGRAPH eliminates tedious calculations in converting total or velocity head of a fluid into its equivalent pressure. See preceding page. Example 1 given in text is plotted by broken line

0.61) nozzle of 0.01 sq ft area. What is the instantaneous flow through the nozzle?

Solution: $q = AK\sqrt{2gh}$; therefore, in column B for $h = 155$, read $V = 100$ in column B1; and $q = (0.01)\ (0.61)\ (100) = 0.61$ cfs.

Example 8:

If the density of a fluid is 0.08 lb per cu ft, what is its specific volume?

Solution: In column C for $\rho = 0.08$, read $\overline{V} = 12.5$ cu ft per lb in column C1. ≠

INDUSTRIAL VENTILATION:

How to Design Makeup Supply Air Systems for Freeze Protection

● Industrial plants which require 100 percent outside air for ventilation must have these systems designed for reliability and protection against freezing. Each component is critical, since it takes the failure of only one to open the door to freeze-ups.

The author has had many years' experience. A graduate marine engineer from the University of Michigan, he has held his present position for the past six years. He is the newly appointed chairman of the Research Advisory Committee on Industrial Environment for the ASHRAE. Author of many articles for Heating, Piping & Air Conditioning, most recently he has written on the subject of industrial ventilation in the April through November 1958 issues. In case you haven't already, you are urged to read these straightforward approaches to industrial plant ventilation design.

BY JOHN H. CLARKE
Engineering Design Supervisor
Air Conditioning and Power
Visking Co.
Div. of Union Carbide Corp.

IN INDUSTRIAL AREAS it is frequently necessary to design supply air systems for 100 percent outside air to provide the necessary makeup air for process, exhaust hoods, or combustion. In some few cases these systems may be designed for recirculation of building air and will operate at minimum outside air volume in the winter to provide the makeup air and heating required, and operate with 100 percent outside air in the summer in order to provide heat relief. These systems must be designed for reliability and protection against freezing.

Many factors are involved in freeze protection. It is necessary to consider the requirements of all of them in order to have a well designed system. When all are considered, the problem is minimized to the point where the likelihood of freezing is remote, and for all practical purposes the system will operate safely.

It takes the failure of only *one* component to cause freezing. Fundamentally, during freezing weather, anything which will prevent drainage of the air heaters or will cause steam to enter the first heater (preheater) section in small quantities can cause freezing and damage. An air heater which is well loaded with steam and completely drained will not freeze.

The first necessity of a well designed system is that steam be provided from a reliable, *clean* source at constant pressure. Oily waste steam, for instance, while seldom used is highly undesirable because of the viscous coating which will cover all interior surfaces, and cause plugging at strainers and traps. The excessive use of pipe dope is another prime cause of system failure, and it is one of the most difficult problems to overcome. Because of this it is essential that new systems be carefully cleaned and provided with adequate strainers that are frequently checked when the systems are first put into service.

The steam and condensate systems available for air heating in industrial areas will vary with the heat balance conditions of the individual plant. Because of the need to return condensate from wide areas and many different services, many plants use gravity returns to area atmospheric tanks. The condensate is then pumped back to the boiler room. In some chemical plants and refineries no condensate is returned to the boilers, so the condensate drainage from the equipment is always atmospheric. Where such systems are provided, it should be clearly understood that they are inherently exposed to considerable quantities of air. Consequently, corrosion protection of the piping should be provided.

For such systems, steam at 10 psi is recommended as a good all-around compromise. While higher pressures are frequently used (25 to 50 psi), greater care must be taken in sizing the control valves and obtaining good poppet (disc) design so as to provide good control without hunting and without overheating in mild weather. The latter is difficult to avoid at higher pressures because of the leakage which may occur after the valve has been in service for some time and because of the inability of the valves to control the steam flow for the first increments of opening. Also, with higher pressures more flash steam will occur in the condensate.

At pressures under 10 psi the pressure drop available across the control valves and traps approaches a marginal value which necessitates larger and more costly valves and traps, increases the possibility of control hunting

because of a lack of differential pressure and a tendency to oversize, and makes the drainage problem more critical. The effect on control valve and trap capacity is indicated in the following table:

Initial steam pressure, psi	Control valve differential pressure, psi	Pressure loss through air heater, psi	Steam trap differential pressure, psi
10	5 (10 to 5)	1 (5 to 4)	3 (4 to 1)
5	2 (5 to 3)	1 (3 to 2)	1 (2 to 1)
2	1 (2 to 1)	½ (1 to ½)	½ (½ to 0)

Under the above conditions the control valve at 10 psi would have a capacity approximately 1.5 to 2.0 times the capacity of the valve at 5 psi and 2.5 to 3.0 times the capacity of the valve at 2 psi.

The losses which must be allowed for in the condensate return piping will also affect the problem. Where other than a vacuum system is used, some positive pressure must be available either as steam pressure or as static head in order to make the condensate flow to the receiver.

In plants where vacuum return systems are installed, steam pressures of 5 psi are quite common. These provide available pressure differentials similar to the 10 psi steam systems (with atmospheric drains) previously described. This assumes that the systems operate at 10 in. Hg vacuum. High vacuum systems (25 in. Hg) are generally untenable in industrial plants because of the variety of steam services required, because of the difficulty in avoiding leaks, and because packless valves must be used and these come only in small sizes. Even in the low vacuum systems (10 in. Hg), extra care must be taken to avoid air leaks or leaking steam traps. It is believed that, for the protection of the air heaters, the piping design should permit adequate drainage of the air heaters even during a temporary failure of the vacuum.

Must Have Constant Steam Pressure

One problem of steam supply that is often neglected is the requirement for *constant* steam pressure. Even with all other design factors as they should be, a varying steam pressure can throw the temperature control valves into a dangerous hunt which might cause freezing. Consequently, even for low pressure boilers in those plants where the boilers operate on an on-off control, a pressure reducing station is highly desirable. This will not only smooth out the pressure variation to the control valves, but will also permit greater latitude in the operation of the boilers. As with any control valve, the pressure reducing valves must be carefully selected. They must be of the right type for the service and must not be oversized. Because heating loads may vary from zero to maximum, the reducing valves should be of the single seated, dead-end type. This is a fundamental requirement for all heating system control valves.

The internal piston type, pilot operated reducing valve should not be used for building heating services. Generally, manufacturers will make it clear that these valves will not maintain regulation below 10 percent of capacity. In actual service as the control passages and clearances are coated with scale and sludge, these valves become less reliable and have a characteristic of operating over the set pressure at light loads and under it at the maximum loads. Such valves at 10 psi settings have been observed many times when the controlled pressure would vary from 15 to 5 psi for the light and maximum loads.

Good self-contained diaphragm or air dome, or pilot operated, pneumatic, diaphragm valves are available and should be selected as applicable. Considering the essential nature of most industrial makeup supply air systems, the pilot operated, pneumatic, diaphragm valves are preferred. They are a little more expensive but they provide good control and are more reliable.

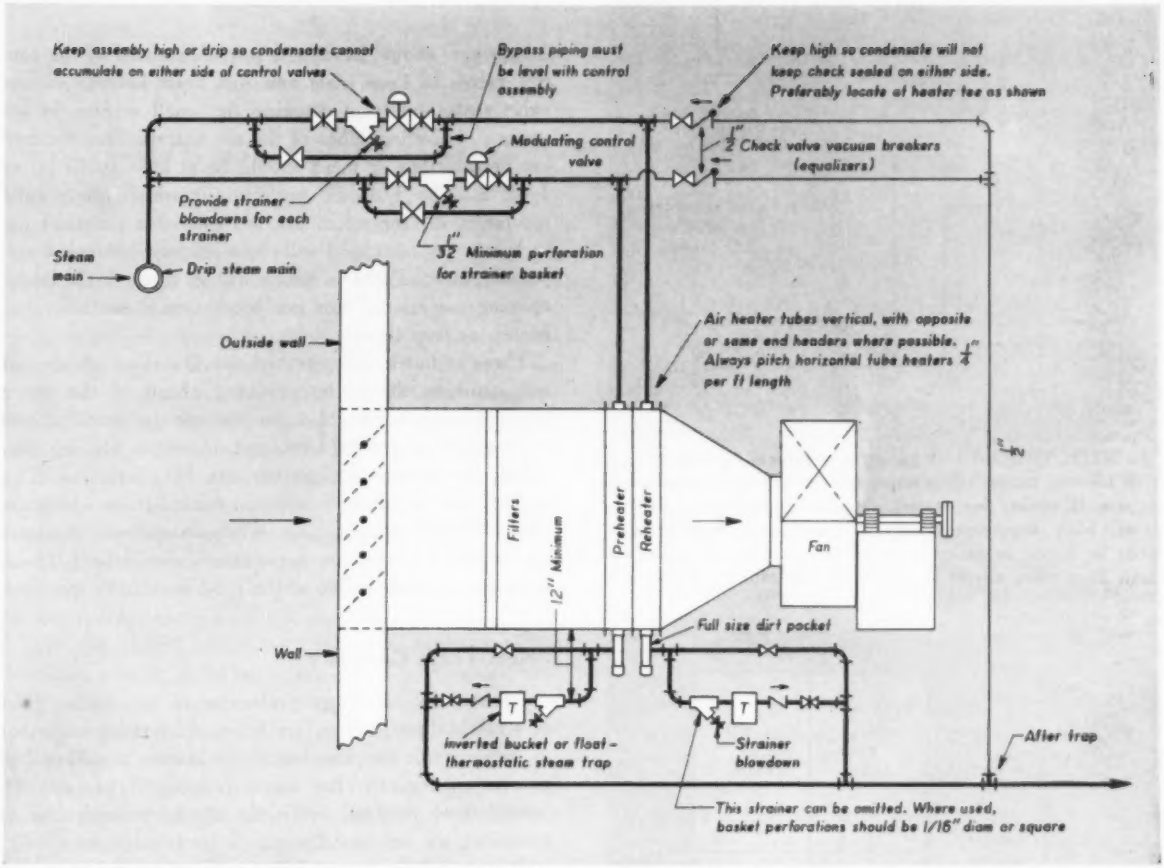
Usually, the pneumatic valves are purchased as normally closed. This is recommended unless the air source might be unreliable. Such unreliability might indicate the need for a different type of valve or at least a normally open valve (will fail open) for essential systems which run continually. However, if a normally open pneumatic valve is provided, all equipment must be designed to operate at the primary steam pressure. Control valve diaphragms are not always adequate to close against excessive pressure. This also presents a problem where inverted bucket traps are used, because these will close and *stay* closed when subjected to pressures in excess of the service design pressure stamped on the trap. (The service design pressure should not be confused with the body pressure rating.) Of course, adequately sized safety valves should always be provided following the reducing valves to protect the equipment.

Pressure reducing stations frequently require more than one reducing valve in order to control properly at light and heavy load conditions. Two parallel, sequenced pressure reducing valves sized for one-third and two-thirds of the total design load provide a flexible and practical pressure reducing station for most steam loads.

Design for Control Valves to Be at High Point

The piping should always be designed with the control valves located at a high point with respect to the steam main and the air heaters. This permits the condensate to drain either way during shutoff conditions. Where this is not possible, drip traps should be provided ahead of and following the controls, as necessary, to avoid the accumulation of condensate. See Figs. 1, 3, and 4. This will prevent one cause of water hammer and resultant heater damage, and will avoid a water condition which could cause freezing. Several engineers have pointed out that many cases of tube failure which have been attributed to freeze-up have actually been caused by water hammer. Double header air heaters with the tubes vertical (headers at the bottom) will require a drip trap for the bottom feed steam pipe, as indicated in Fig. 3.

The condensate piping should be uniformly pitched and should be free of high spots or pockets in its run to the condensate receiver—whether atmospheric or vacuum. Inadequate piping supports may be one cause of pockets. If pockets are necessary, they should always be vented over and across the pocket to permit the flashed steam to


Keep assembly high or drip so condensate cannot accumulate on either side of control valves
Bypass piping must be level with control assembly
Keep high so condensate will not keep check sealed on either side. Preferably locate at heater tee as shown
Modulating control valve
1" 2 Check valve vacuum breakers (equalizers)
Provide strainer blowdowns for each strainer
1" 32 Minimum perforation for strainer basket
Steam main
Drip steam main
Outside wall
Air heater tubes vertical, with opposite or same end headers where possible. Always pitch horizontal tube heaters 1/4" per ft length
Filters
12" Minimum
Preheater
Reheater
Fan
Full size dirt pocket
Wall
Inverted bucket or float-thermostatic steam trap
Strainer blowdown
After trap
This strainer can be omitted. Where used, basket perforations should be 1/16" diam or square

1 TYPICAL DIAGRAM for supply air systems handling 100 percent outside air. Note that vacuum breaker (equalizer) is connected at steam side of heaters. Bottom connections are not correct. Strainer blowdowns (See Fig. 4 also) have been added to diagram, as suggested by John Everetts, Jr. See his comments in text on desirable minimum distance between heater outlets and traps. For alternate or supplementary air venting, and particularly for float traps, thermostatic trap bypass should be provided *over* main steam trap

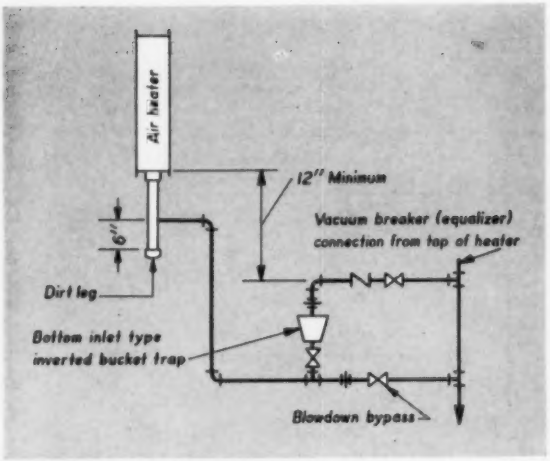
escape. Otherwise, water hammer and vapor binding will occur.

The condensate should not be discharged at a level above the trap, nor should the condensate pipe be led above this level at any point between the trap and the receiver because modulating control valves also act as pressure reducers. At partial loads or during hunting when a control valve is nearly closed, the steam pressure may not be sufficient to discharge condensate against a positive head. Actually, vacuums in excess of 22 in. Hg have been observed in air heaters under such circumstances. Obviously in such cases it is not possible to discharge condensate above the trap or the heater. A flooded heater will freeze rapidly when exposed to air below freezing temperature. In those exceptional cases where it may be necessary to discharge above the trap and heater, a two-position control valve must be used for the preheater section and full steam pressure must be maintained on the heater at all times during freezing weather. This is still poor protection, however, because low steam pressure or failure of the two-position steam valve can cause trouble. *The use of high condensate discharge and two-position control is not recommended because of the inherent risk of freezing the air heaters.* It should be noted that, even for the reheaters and booster heaters that are not subject to freezing, water in an air heater will cause hunting and water hammer with modulating control. Such water hammer will lead to ultimate rupture of the tubing.

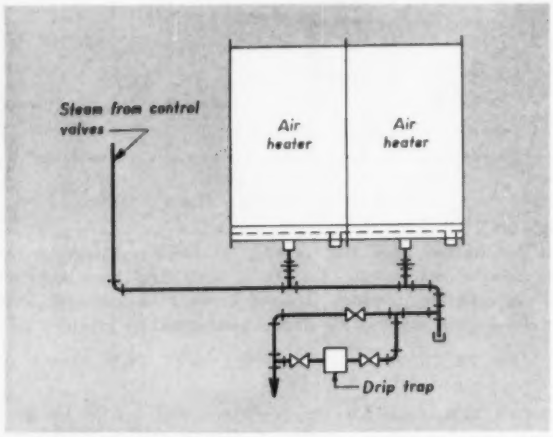
In connecting the piping to the heaters it is very important to keep it out of the system casing and the freezing air stream, particularly the condensate lines and traps. If the piping must be within the casing, it would be best to keep it downstream of the air heaters or, as a last resort, insulate the piping if it must be installed in the cold air stream. However, this is risky.

Condensate piping sizes smaller than $\frac{3}{4}$ in. are not recommended. The piping from the heater should be run to a full size dirt leg at least 12 in. deep (and preferably deeper). This is discussed later, under "Select Traps Carefully." This provides a good water reservoir which will help to keep water out of the heater at startup or during fluctuating loads or hunting.

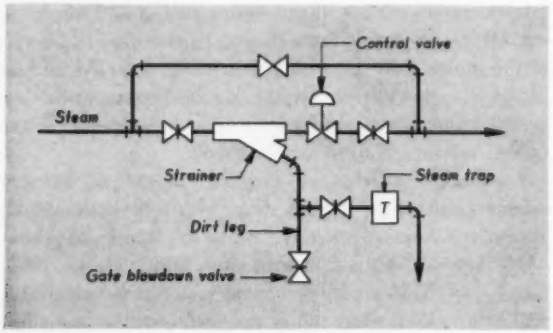
The trap connection should be made about 6 in. above the bottom of the dirt leg and should be reduced to the size required for the condensate capacity. Usually this will be a size or two larger than the trap connection, depending on the type of trap.



2 WITH THIS alternate piping arrangement for bottom inlet type inverted bucket steam traps, dirt can be blown through the bypass. However, this unseals trap and it must be resealed or it will blow steam continuously. To seal it, trap discharge valve must be closed to permit condensate to enter trap and form seal. Then valve should be opened to put trap into service



3 DRIP ARRANGEMENT for steam piping to double header (steam and condensate connections at same end) air heaters installed with tubes vertical shown here. Bypasses are not necessary for such drip traps and may be omitted



4 BLOWDOWN AND DRIPPING arrangement for strainer ahead of control valves illustrated. Blowdowns should be provided for all strainers of heater assembly wherever practical. Blowdowns permit easier maintenance of strainers, provide greater assurance that steam and condensate flow will be maintained. Drip trap on control valve strainers assures dry line ahead of control valves

Strainers should always be provided ahead of the control valves to keep scale and dirt from lodging on the valve seats and from clogging the small orifices in the steam distributing tubes of the air heaters. Strainer basket perforations or mesh should be at least 0.045 in. or 1/32 in. The 1/64 in. perforations which are usually recommended for steam are too small for practical use in heating systems, and will cause excessive plugging and pressure drop. Particles which will go through the larger openings mentioned are not apt to cause control valve, heater, or trap trouble.

There is much difference of opinion as to whether or not strainers should be provided ahead of the steam traps. Where a control valve strainer is provided and maintained as it should be, and an ample dirt leg provided, the condensate strainer can be eliminated. This is particularly true with inverted bucket traps which are less vulnerable to plugging. Where condensate strainers are provided the basket perforations should be 1/16 in. diameter or mesh in lieu of the 1/32 in. usually specified.

Select Traps Carefully

Inverted bucket traps, preferably of the bottom inlet or straight-through type, are believed by many engineers to be desirable for ventilation air heaters handling 100 percent outside air. They do not require thermostatic differentials to operate. Since the discharge operation is turbulent, the accumulation of sludge is minimized.

It is commonly believed that inverted bucket traps will not vent air adequately. Personal observation of a number of tests using standard traps has not substantiated this. However, inverted bucket traps are available with bimetallic, thermostatic elements for rapid air venting. If desired, external thermostatic trap bypasses can be provided over the traps in lieu of the internal vent.

Float and thermostatic traps are frequently recommended for this service and have a large number of adherents. However, these traps are more vulnerable than inverted bucket traps to the accumulation of sludge. This sludge can build up to the point where the float will no longer operate and the orifice will plug. The thermostatic elements are particularly unreliable because the corrugations fill or are covered with sludge and the elements fail to open properly for venting.

Where the float trap is preferred it is recommended that careful attention be given to servicing and the use of strainers. The air venting should be done externally by a thermostatic trap on a bypass over the float trap. The external thermostatic trap will be more reliable because it is not in the flow of condensate and will be less apt to accumulate sludge. Such elements should be checked often to see that they are working properly.

Thermostatic traps by themselves should never be used to drain air heaters because of their unreliability, the requirement for a cooling leg and a temperature differential in the condensate in order to operate and because they are relatively slow in acting. Several steam traps which operate on principles other than the thermostatic

(or bucket or float) are available and can be used where they fit proper service conditions.

Provide Steam Trap for Each Air Heater

A steam trap should be provided for *each* air heater of a multiple heater installation. The trap capacities should be based on realistic differential pressures across the trap, taking into account steam line friction, control valve and air heater losses, and the back pressure or vacuum in the condensate line. The steam traps should be selected for about two to three times the capacity required for the air heaters so that the greater than normal "startup" loads of condensate can be quickly drained from the air heaters, and to provide adequate air venting capacity.

There is no advantage in going beyond these capacity ratios. Excessive ratios can cause steam leakage and will result in needlessly expensive traps. Steam should always be on the air heaters before the ventilation systems are started in cold weather. If proper procedure is followed, excessive starting-up load will not occur.

The trap should be located a minimum of 12 in. below the heater outlet, as previously mentioned. This will provide some cooling leg and some static head over the trap to maintain condensate flow. It will also minimize the possibility of holding condensate in the air heaters. In the case of bottom inlet, inverted bucket traps, the 12 in. minimum would be to the centerline of the horizontal discharge pipe from the trap.

John Everetts, Jr., of Charles S. Leopold, Consulting Engineers, Philadelphia, has made several excellent suggestions in this regard: "The distance from the intake of the trap to the bottom of the heater should be 1.25 to 1.50 times the pressure drop through the trap. For example, with ½ psi drop, this would be a distance of 21 in., and for 1 psi drop it would be a distance of 40 in. If space requirements are such that this height cannot be obtained, then the traps must be selected for a lower pressure drop. This will assure sufficient head on the traps to provide the required flow without the condensate backing up into the heater where it could freeze." Inherently this is more easily done with float than with inverted bucket traps.

Mr. Everetts' second point is that the strainers should have blowdowns wherever practical, and the control valve strainers should be equipped with a trapped drip as shown in Fig. 4, which will assure a dry line ahead of the control valve. The blowdowns will go a long way toward improving strainer maintenance and assuring proper steam and condensate flow. The recommended piping connections are shown in Figs. 1, 2, 3, and 4.

Install Vacuum Breakers Between Valves, Heaters

Vacuum breakers (equalizers) should always be provided between control valves and air heaters to prevent the formation of vacuums which will hold condensate in the heaters. These should be installed regardless of whether two-position or modulating control valves are provided. The only exception to this would be for a flooded system as previously mentioned, where the condensate is discharged above the level of the trap and heater.

Vacuum breakers should be connected as shown in Fig. 1 for either atmospheric or vacuum return systems. Where no condensate is returned to the boilers or for atmospheric drains, the vacuum breakers may open to the atmosphere instead of the condensate line. Where atmospheric drainage is provided, air is admitted to the heater and drain system, and corrosion control should be provided as previously noted.

Vacuum Breakers Keep Water out of Heaters

While the vacuum breakers are provided for the preheaters primarily for freeze protection, they also provide better control by keeping water out of the heaters. This reduces the possibility of hunting. Consequently, the vacuum breakers should also be used for the reheaters.

It is very important that the vacuum breaker *not* be connected from the heater drain to the trap discharge, as it is sometimes done, unfortunately. This connection is wrong for the same reason that it would be wrong to place an air vent for drainage in the bottom of a tank. Obviously, the vent should be placed at the top, whether for a heater or for a tank. While a vent (equalizer or vacuum breaker) at the bottom of an air heater may permit an air heater to drain (depending upon its design), there is no assurance that it will. The sure way is to stick to sound principles of drainage venting.

Despite many inquiries as to how the incorrect vacuum breaker diagram got its start, it has not been possible to determine its origin. Thomas H. Urdahl, consulting engineer, Washington, D. C., first called attention to the need for, and the correct method of vacuum breaking in 1942. This was also in accordance with the Navy Department Standards of that era. Subsequent installation tests further substantiated that the top connection was correct. Samuel R. Lewis, consulting engineer, Chicago, confirmed that he had been using the top connected vacuum breaker for many years. It would be interesting to know where the inspiration for the bottom connection came from.

The vacuum breaker can either be a thermostatic trap or a check valve. It is believed that the small leakage of a check valve is preferable to the uncertainty of a thermostatic trap. The seat angle of the check does not appear to be important, but the 45 deg seat might be preferable.

Shutoff valves on the steam side of the check are desirable for servicing and for checking leakage. The check valve vacuum breaker and its piping connection to the steam line should be such that water cannot accumulate on either side of the flapper and prevent adequate air passage. For this reason its connection at the heater tee is preferred. It should be noted that the check valve opens to the steam side.

The next article in this industrial ventilation series will discuss controls and piping for these systems. ≠

SAMUEL R. LEWIS, consulting mechanical engineer and a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors, comments informally each month on practical problems in the field.

Sam Lewis says:

"Each Classroom Should Have Separate Chimneylike Air Escape Flue"

IT GRIEVES us all to think that nearly 100 Chicago girls and boys on December 1 were trapped and lost their lives in a holocaust inside the second story of a school building.

It is reported that smoke filled the corridor. It appears that the stairway —the only means of escape—must have been rendered impassable by fire and resultant gases.

An heroic teacher in an upper story room attempted to seal off the entry of smoke by plugging the under-door cracks with textbooks.

Apparently the heat of combustion entered the classrooms from the second story corridor, despite the efforts of the firemen to open an escape for gases.

Another schoolhouse fire occurred at Collinwood, Ohio, near Cleveland, about 50 years ago. This school, like the one in Chicago, had windows through which many of the children might have escaped. However, they panicked and piled up at the exits and were suffocated, if not actually burned.

The codes covering school construction in Ohio were implemented after that fire, though there is some evidence of relaxing during recent years. Stairs in Ohio schools of combustible construction were replaced by masonry or metal, and the spent air expelled from each classroom by pressure of the air supply fans, must have a separate escape passage to the atmosphere.

No longer could the exhaust air from classrooms flow into an open attic and then escape via hooded openings through the roof or belfry floor. No longer was it permissible to use the general corridors of a school building as exhaust air passages via the stairways to relief or escape openings through the ceiling of the top story corridor.

Each classroom today should have a separate, noncombustible, chimneylike air escape through the roof to the outside. Such construction should bring about reduction in fire casualties, even though doors from classrooms to corridors may be open while a fire is active.

We approach the day when vertical passages for smoke to flow from story to story of a school building will be provided with automatically-operated dampers. Stairways will have doors at every floor.

As a member of Chicago's committee on building code recommendations, I shall vote for compliance with the recommendations of Mayor Richard J. Daley for installation of automatic sprinklers in institutionally occupied buildings of two or more stories and of nonfireproof construction. Direct connection of school fire alarm systems with the city fire alarm system should also be required, in my opinion. ∓

Air Pollution, Waste Control Is Individual Plant Project

"It's up to each plant to organize and enforce an industrial wastes abatement program as a local 'good neighbor policy,'" industrial wastes authority tells the 10th Plant Maintenance & Engineering Conference

EACH COMPANY, and perhaps each plant of a company, can be expected to have a different approach toward air pollution control, stated O. C. Thompson, coordinator of waste abatement for Union Carbide Chemicals Co.'s general industrial relations department, in his address at the recent 10th Plant Maintenance & Engineering Conference in Cleveland.

This is only natural, he said, since there are wide organizational differences between companies, and often between different plants of the same company. Organization for air pollution control will vary. It may be set up as a staff function, as a line responsibility, or as a combination of both. It can be expected to vary depending upon size of plant, type of operation, location, general attitude of the community toward industrial operations, and the legislative situation with respect to air pollution control, he said.

The organization and programming for air pollution control begins with a clearly understood company policy. Written policy statements seem the exception rather than the rule.

Mr. Thompson said that his company, with seven plants in five states, has a five-step written policy specifically covering process wastes and related community relations, as follows:

1) Design engineering departments are responsible for incorporating into the design of any new installations the means for disposal of all process wastes with a minimum of disturbance to the plant community.

2) Each operating plant will assign to some individual the responsibility for proper disposal of process wastes.

3) Each operating plant will assign engineering and laboratory personnel for continuing studies of waste disposal.

4) Each operating plant will take an active part in any local committee groups or branches of agencies or trade associations interested in industrial waste disposal.

5) Each operating plant will assign to some individual the responsibility of representing the company to the public on all matters pertaining to air or water waste disposal.

This written policy has proved to be of great value, he reported. It puts the responsibility for plant wastes control squarely where it belongs—on the plant management. It does something else of great value. It makes clear that control of wastes begins with product research and development in the laboratories and that this control is extended through engineering and the design and construction of each plant unit.

Put Technical Knowledge To Work

So much for the overall concept and policy with respect to the control of wastes, he said. What about the technical problems involved in air pollution control?

An enormous volume of technical knowledge has been published on the many aspects of air pollution. Universities, foundations, consulting services, industrial companies, trade associations, and other agencies, including all levels of government, are now engaging in development and research on air pollution. The outpouring of published papers has become so great that bibliographies of newly published work are now issued on a regularly scheduled basis, he said.

Now how can all this technical knowledge be organized

and put to work? A search was made through a bulging bookcase of published papers, proceedings of numerous conferences, and textbooks on air pollution. One of the items that supplied such information was by William G. Christy. Although the exact application may vary in different plants, the advice by Mr. Christy on the organization and operation for air pollution control could be of practical value to any plant faced with this difficult problem. The following steps are recommended for the organization and operation of plant air pollution control:

1) *Place responsibility.* A qualified individual should be given the responsibility of wastes control of the plant. This may be limited to emissions to the air or may include processing wastes of every nature.

2) *Form a committee.* In some large plants with many production units of varying types, the forming of a committee has been found to be a successful means for arousing interest in and developing the practices necessary for wastes or pollution control. Usually a representative of each major department is designated for such a committee.

3) *Assign inspectors.* These are often plant guards, watchmen, or other employees whose duties require them to frequently move about the plant. Such inspectors should watch for and promptly report any excessive emissions.

4) *Evaluate your problem.* A beginning of this evaluation could be an inventory of emissions. For this, a questionnaire, to be completed by the head of each department or processing unit, has been found useful. Once the inventory is completed the evaluation process can begin. A wide range of treatments can be expected. These may include engineering studies resulting in redesign or replacement of equipment, intensive campaigning for better "housekeeping," comprehensive plans for an educational program, etc.

5) *Inform your people.* Recently a sanitary engineer member of a state water pollution control board offered a suggestion. He thought that, since the problem of plant water pollution control was comparable to the never-ending efforts to improve employee safety, the same methods for "selling" it to plant personnel could be used. The same can be said of plant air pollution control. Just as is done in many plants in carrying out safety programs, the use of posters, articles in plant bulletins, and group training in proper operation and maintenance are all applicable for plant air pollution control.

6) *Keep active.* This may seem an unnecessary admonishment. Yet all of us have seen fine programs started with much enthusiasm generated, only to soon "run out of gas," he said. Careful planning can prevent such failures—if only attainable objectives are set—if the working group is imbued with the necessity of cleaning up and *keeping* clean. In other words, if air pollution control is

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Air Emissions Survey

Dear Mr. _____:

The Head of each Operating Department is requested to develop the following information:

(1) Summarize and tabulate all wastes, gaseous or particulate, at present being discharged to the atmosphere from the buildings and operating areas under his jurisdiction. The waste sources will include still and reactor vents, tank vents, smoke stacks, compressor discharges, etc., etc. The data will cover the following required items:

(a) Quantity of organic and/or particulate material involved in each stream, in pounds per day or month, whichever is most convenient.
(b) Volume of waste stream in cubic feet per minute.
(c) Pressure and temperature at which it is vented.
(d) Other information such as range of variation, whether continuous or batch, etc.

(2) Your suggestions and recommendations as to how the waste materials may be reduced in quantity at the source, or disposed of to reduce atmospheric pollution.

This information is to be turned over to the writer for compilation. The purpose of this outline is to secure uniformity in the information obtained.

Very truly yours,

FIRST STEP in evaluating air emissions problem in a plant is to take inventory of sources. Questionnaire, such as is shown at left, can be completed by head of each department or processing unit

"Cooperate with other industries in the area; win the confidence of the community"

made one of the normal functions of plant operation and maintenance, the program need not fail.

Must Go Outside the Plant, Too

Experience has proved the value of certain beyond-the-plant activities. Three of these he added to the list as deserving of consideration.

7) *Cooperate with other industries in the area.* This may include active representation in a local chapter of the Air Pollution Control Association. Plant interests may be served best by an informal group made up of personnel active in the pollution control within the plants of the area. More formal developments of area industrial pollution control organizations have been created, any one of which can be an excellent forum for discussion of mutual problems and exchange of experiences.

8) *Win the confidence of civic leaders, health officers, and other agencies of the public.* It should be recognized that the local health officers or members of the municipal governing body can be a plant's understanding friends. It is good practice to invite these people into the plant. In this way they meet the responsible members of management and see for themselves the magnitude of the operations and pollution problems. They can then speak with the authority of knowledge when dealing with their public. And it is well to remember that accidental discharges of dusts, gases, etc. can occur in the best regulated plant!

9) *Develop good community relations.* The word "community" as used here means the relatively small group held together by common interests, as typified by the average town and its industries. Each plant must be a "good neighbor" in its own community.

A few guideposts on how to do this are:

a) *Tell the employees.* This is the most important single group for at least two reasons: First, air pollution abatement *depends* upon the cooperation of the employees. Second, employees can be the most effective agents for good community relations, by telling their friends and neighbors of the company's efforts.

b) *Arrange plant visits.* Conducted plant visits can be very effective. These can include employees' families, neighbors, and the opinion-forming leaders of the community — clergymen, educators, local officials, and the press.

c) *Keep enforcement agencies informed.* As one industrial engineer of a well-known air pollution control agency has stated: "All we ask of industry is honest effort and information about what it is doing. Among other ends it serves, this information is often used to defend industry against public accusations."

d) *Handle complaints promptly.* This should be self-evident. Yet, how many plants have *all* supervision alerted to investigate complaints promptly?, he said.

e) *Establish good press relations.* The press is essentially fair-minded and the public is remarkably patient — if the facts are made available and if they indicate actions in good faith.

How Some Actual Problems Were Solved

Mr. Thompson related a few examples of actual plant problems within his company and told how they were handled. He said that to avoid water pollution of the Kanawha River, chlorinated hydrocarbon wastes of the South Charleston, West Virginia, plant were burned in an open burner. This seemed a happy solution to a serious problem—until some new catalyst mixtures were burned during a two-day atmospheric inversion with nearly 100 percent relative humidity. To make a long and sad story short, that unhappy coincidence caused damage to the finish of hundreds of automobiles, he said. The important point to emphasize is the way this expensive lesson has been used to prevent repetition.

Metal plates, painted with car lacquers and enamels, are now placed around the plant. Plant watchmen and gate guards are instructed to note and promptly report to the supervisors on duty any unusual emissions. By this means and by the regular inspection of the paint samples, no recurrence of extensive auto finish damage has occurred.

A particle fall survey is being conducted in the general area surrounding one of the company's plants, he reported. This is a cooperative project in which his company and a neighboring plant of another company share the work and the costs. When this was being planned, it was agreed that the State Health Dept. should be invited to participate in the technical discussions. By bringing the technical staff of the Health Dept. in on this work as it was being started, the equipment, methods of analysis, interpretation of results, and all other technical matters have been agreed upon by the industrial teams and the responsible health agency of the State.

This survey is an interesting example of one of industry's most difficult air pollution problems. It involves fly ash emission from pulverized coal fired boilers. Many plants have community relations problems because even the most expensive combinations of mechanical and electrostatic precipitators cannot prevent some dust escape to the air. The operation and proper maintenance of this type of equipment typifies the importance of the human element in the control of industrial air pollution, Mr. Thompson concluded. ∓

the law and your profits

WILLIAM HURD HILLYER, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. He has an extensive practical legal and financial background. This series presents actual cases. All names are, however, fictitious. It should, of course, be remembered that the law varies in different states.

Contractor Ekes Out Close Decision

CONTRACTORS installing heating systems in large developments of several buildings are often faced with "rough conditions" in order to fulfill their undertakings. Needless risks, which may result in injuries, cause many problems — as pointed out in the following case:

The Goodenuff Corp., a general contractor, contracted with Will Takerisk to install heating systems in a project under construction by that company.

While leaving one of the buildings in the course of his work, Takerisk twisted his ankle. No front steps had been provided at the doorway of the building and no ladder, although ingress and egress were necessary for him to do his work.

Injury had been incurred by Takerisk in letting himself down the 4 ft drop. He sued Goodenuff for damages, alleging negligence.

The trial court dismissed his action on the ground that he had assumed the risk. He appealed to the superior court, where defendant Goodenuff sought to justify the action of the trial court on that same ground. Goodenuff argued that the evidence presented no case for a jury, respecting the duty of the general contractor to the heating contractor.

Plaintiff Takerisk had been in and out of this building, as well as several other units in the development, many times without trouble until the accident. He and other men had also worked without benefit of steps and without ladders.

In trial court Takerisk answered questions as follows:

Q. "When you came to the project and saw this situation, did you do anything about it?"

A. "There wasn't much we could do. We don't build stairs, we just install heating equipment."

Q. "Did you speak to anyone about it?"

A. "Well, it was generally felt that it was a 'rough' way to get in and out of the buildings, but what could we do? We all have to work."

Cross examination brought out the fact that there were insufficient ladders to supply Takerisk with one, and also the circumstance that Takerisk did not sit before jumping, because of protruding nails and the roughness of the wood. He had "crouched down and jumped."

Goodenuff urged that from plaintiff Takerisk's own testimony it must be concluded that he jumped from the doorway, which was 4 ft above the ground. The trial court's remarks in ordering the dismissal of the case indicate an apparent concurrence in that conclusion.

"However," the superior court appellate division held on appeal, "it is elementary that on a motion for dismissal, the plaintiff is entitled to every favorable legitimate inference possible from the testimony . . . So viewing the proofs, the jury could have found that the plaintiff crouched or squatted on the doorsill, let his feet down, and then dropped his body, and that the ensuing jump or drop of the plaintiff's body to the ground encompassed only the distance of 2 ft from his feet to the ground, rather than the 4 ft from doorsill to the ground."

In a headnote to its decision reviewing the trial court's dismissal and finding favorably for plaintiff Takerisk, the higher court held: "Where proven facts permit inference that the defendant has breached a duty to the plaintiff, mere knowledge by the plaintiff that there is risk involved" does not bar his action for injuries, under theory of assumption of risk.

The alleged contributory negligence, the court held, "must be seen conclusively as a fact or as a necessary and exclusive inference from the plaintiff's proofs. We think the issue here was for the jury. That body might have found that it was not unreasonable for the plaintiff to take the risk of a 2 ft jump or drop from the doorsill in view of the number of times he had safely taken comparable risks previously in that and other buildings in the development."

While it is true that Takerisk won his suit by taking it to the superior appellate court, the appeals are always costly. Only time will tell what future troubles may arise from his injured ankle. ∓

Polyester Ducts Repel Sticky Pigments

. . . to meet stiff process exhaust needs at Kodak's photographic paper coating operation in Rochester, N.Y. System was economical and easy to install, is fire resistant and easy to clean, and requires no insulation

BY WALTER PETER
Mechanical Engineer
Kodak Park Engineering Div.
Eastman Kodak Co.

WHEN IT BECAME necessary to replace the exhaust system in a photographic paper coating operation at Kodak Park Works, Eastman Kodak Co.'s largest manufacturing plant, the problem was easy to define.

The new ductwork had to resist the slight corrosion caused by chemicals entrained in the exhaust air. It had to be easy to clean and resist the adherence of an insoluble pigment to the inside wall. Carryover of the entrained material and deposition of insoluble pigment on outside walls in the plant also had to be eliminated.

The adherence of insoluble pigment was one of the largest parts of the problem. A chemical spray composed of pigment, gelatine, formalin, dyes, and water forms around a coating pan and is carried off by the exhaust system. This spray is sticky, adheres well to all metals, and upon drying will harden.

Other considerations in selection of a material for the ductwork were economics, fire resistance, and special installation problems in an area highly crowded with equipment. Large radius elbows were also required in the ductwork to facilitate cleaning.

Investigations centered on several kinds of 6 in. nominal size tubing. All but one — glass fiber reinforced polyester — were eliminated, due either to their inability to meet the physical requirements of the application or because of the high costs of the materials themselves or their fabrication.

Several plants where glass fiber reinforced polyester pipe was in use were visited. This inspection showed that the material excelled in corrosion resistance to most strong acids. Thus, corrosion would certainly not be a problem in the Kodak application. Also, the ease with which it could be spliced would make fabrication relatively simple.

But what proved to be the deciding factor was the poor adhesiveness of polyester. It would therefore repel the adherence of the sticky insoluble pigment. The material's fire resistance was also adequate for approval by the fire underwriters. Its heat transfer coefficient is so low that it would not be necessary to insulate the ductwork against "sweating."

In addition, polyester tank type separators, 3 ft high × 3 ft in diameter, were specified to remove the spray entrained in the air. The separators permitted the use of other nonplastic ductwork to exhaust the air after the disposal of the entrained material.

The polyester ducts and tanks were installed about a year ago, and their operation has been very successful to date. The frequency of cleaning has been reduced from weekly on the old system to only once every six months today; and the job has been simplified to only swabbing and flushing. There have been no leaks nor plugging, and the tank traps have eliminated the deposit of pigment on the outside walls of buildings.

At present, there are 11 hoods in the system, exhausted by 22 six in. nominal diam ducts. Each duct handles 500 cfm of air and 2 gpm of sprayed water, plus the entrained chemicals. The water is sprayed against the inside of the hoods to keep them and the ducts moist during operation. All elbows have 36 in. centerline radii to facilitate swabbing. Ducts are pitched about ¼ in. per ft.

The ducts arrived on the job preassembled and required about three splices per branch between the hood and the separators. Each splice required about 20 min for hardening. No insulation nor painting was necessary. Ordinary strap and clevis hangers spaced 10 to 15 ft apart are used to support the ductwork. ≠

How to Choose the Right Pump For a Closed Hydronic System

The engineer must weigh carefully a system's overall design objectives—and how the pump will affect the operation of the system as a whole—to select the most economically desirable standard pump which will meet them. This selection can be made by using the design tools outlined here.

BASIC DESIGN objectives must be kept in mind when selecting a pump for a hydronic (hot water heating or chilled water cooling) system, as is the case with any engineered selection, stated G. F. Carlson, Bell & Gossett Co., speaking at the symposium on hydronics at the 65th annual meeting of the American Society of Heating and Air-Conditioning Engineers in Philadelphia recently.

Mr. Carlson limited his discussion to the selection of electrically driven centrifugal pumps for hydronic systems which are not open to the atmosphere.

In his presentation he frequently referred to the hydronic system, like any other heating or cooling system, as a heat transfer machine. With these hydronic systems, a pump is a very important component of the complete mechanism.

Good pump selection takes into account how the pump, as a part, will affect operation of the system as a whole. Conversely, good pump selection procedures should also consider that system operation, at changing loads, may affect pump operation, he stated.

Low speed pumps (1750 rpm) are usually considered a better selection for the hydronic system than higher speed ones, he said. This is because, for the same amount of unbalance, vibrational problems are much less severe at the lower speed and because the higher speed pump causes higher frequency vibration rates. At the same energy input per vibration, higher frequency vibration rates will be more annoying.

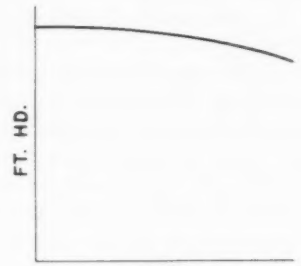
Mechanical and electrically induced motor vibrations must be isolated from the pump proper so that these vibrations are not permitted to enter the system water. Isolation type motor mounting and motor-pump couplings should be provided, and motor and pump bearings should be considered from a mechanical noise standpoint.

As a function of manufacturing design, noise production due to turbulence within the pump casing must be guarded against. Quite often, engineers specify that all pumps must have definite ratios of impeller diameter to what is called "full impeller diameter." It cannot be pointed out too strongly, said Mr. Carlson, that, while all centrifugal pumps are similar, they are still different — one to the other. The definitive type of specification disregards these differences and arbitrarily sets up a relationship which may not correspond to fact. It is the pump manufacturer's responsibility to define internal pump parts relationships so as to provide against turbulence noise. The responsibility should not be placed on the shoulders of the consulting engineer.

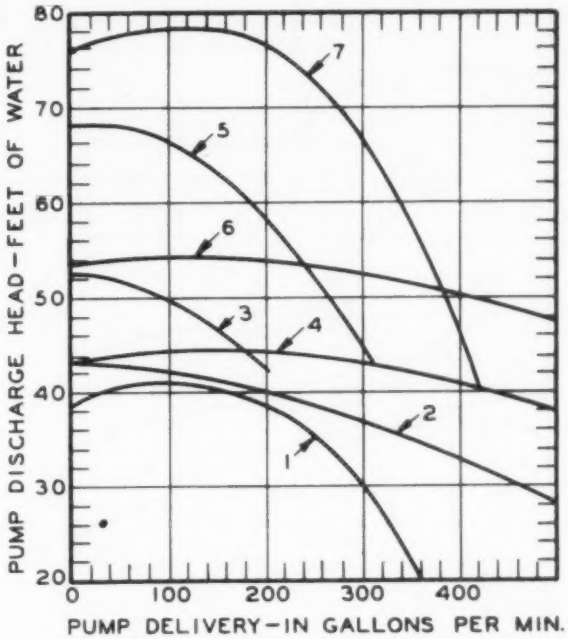
Energy Applied Must Equal Energy Losses

Pump selection, in a strictly scientific sense, is a simple application of the first law of thermodynamics — the energy applied to the circulating fluid by the pump must be exactly equalled by energy losses caused by fluid circulation, said Mr. Carlson.

Pumps are selected on the basis of flow rate and head requirements. System flow requirements may be set up by the manufacturer of heat transfer equipment. Manu-



1 PUMP CURVE defines pump operation. It gives relationship of flow to head over wide flow range for a particular pump. Above is curve for typical pump



2 MANUFACTURERS supply families of pump curves to aid in selection. These illustrate operation for a series of different pumps

facturers of forced convection heat transfer units may require certain minimum water flow rates — either to maintain the rating or for other reasons. For such systems the engineer usually totals individual unit flow requirements, thus determining an approximate minimum pump flow requirement.

Flow requirements for most hydronic systems are based on the heat carrying ability of water. The amount of heat carried by the water is dependent on the water flow rate and on its temperature change during flow through the system.

Must Select Design Temperature Drop

Selection of a design temperature drop for heating or rise for cooling is necessary to proceed with design. This design tool provides an approximate flow rate. This design water flow approximation is necessary for pipe sizing and pump selection purposes.

It is known, of course, that the actual attainment of the exact water flow as determined by the design temperature drop tool is not important for successful system operation. Water flow rate is only important as it affects heat transfer, system response time, and other factors affecting comfort. The hydronic system is not a temperature drop device; it is an easily controlled heat transfer machine, he said.

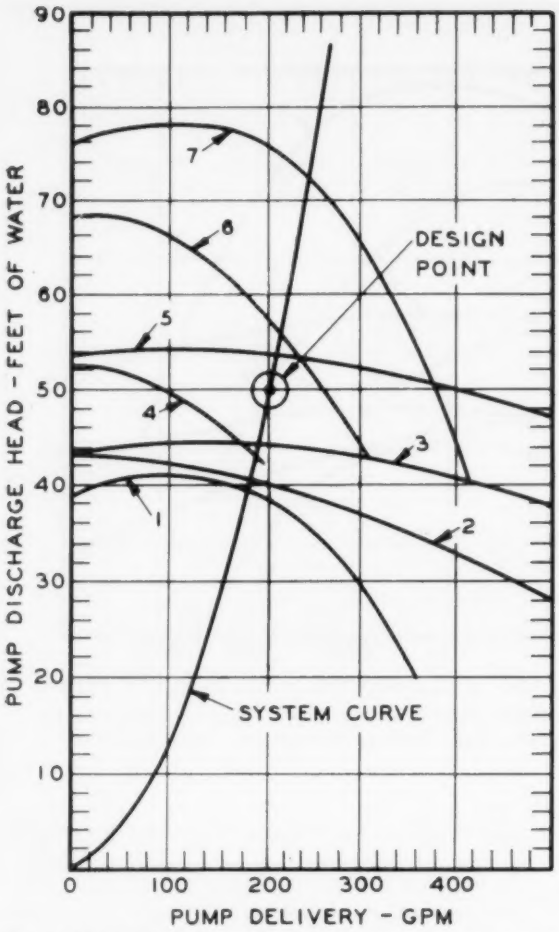
After determining approximate flow requirements, the piping system is designed. Piping size and length will determine needed pump head to deliver the approximate required flow to the system heat transfer units.

Pipe sizing should be integrated with pump selection. This permits final selection of standard readily available pumps *always*. It eliminates the need for special pumps.

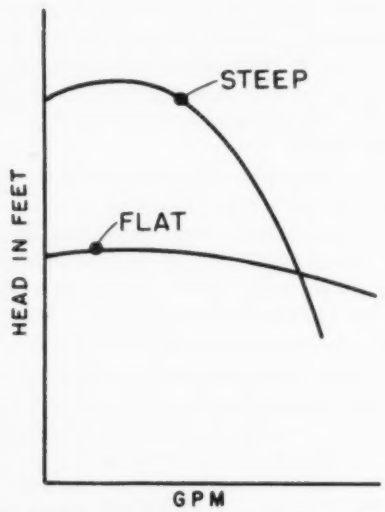
Integrated pipe and pump sizing means that an initial pump selection is made and piping is initially sized to that pump selection by means of pipe sizing tables. The method and pipe sizing tables are outlined in Chapter 21 of the 1958 ASHAE Guide.

Following initial pipe sizing, a pipe size check is made. The pipe size check more accurately determines system pressure drop (needed pump head) for the required flow. It is based on elbow equivalent methods of pressure drop calculations and uses the friction drop charts most adaptable to hydronic system design.

Friction drop charts and tables for the flow of water through piping are many and varied. Some are based on corroded, encrusted piping. These charts should not be used because, in a properly designed and operated closed hydronic system, the piping cannot corrode or encrustate, he said. Friction drop charts based on clean piping should be used. He recommended the ASHAE charts, as in Chapter 21 of the 1958 Guide. The use of charts or tables which indicate higher pressure drops will falsely demand



3 SYSTEM CURVE plotted against family of pump curves gives engineer good working tool to make his final pump selection



4 PUMP CURVES are either flat or steep. Generally, flat curved pumps are preferred for hydronic systems

higher pump heads than are actually needed. Pump selections based on nonrecommended charts will be oversized, and may lead to operating problems, he said.

Given the approximate needed flow rate and an accurately determined system pressure drop, final pump size selection can be made. Pump size selection may be made from pump curves, Mr. Carlson stated.

A pump curve defines pump operation. It states the relationship of pump flow to pump head over a wide flow range for a particular pump. (A typical pump curve is illustrated in Fig. 1.)

Manufacturers also supply families of pump curves. These illustrate pump operation for a series of different pumps. When making a pump selection, it will almost always be found that the estimated system flow and head requirements do not correspond exactly to any curve. For example, a calculated system pressure drop of 50 ft at a required approximate flow of 200 gpm does not correspond to any pump curve illustrated in Fig. 2.

Observing this, the engineer has two choices, he said:

1) He can insist on a special pump.

2) He can select the standard pump which most economically fulfills system requirements.

Selection of standard pumps is always to be preferred, according to Mr. Carlson.

Given a piping system flow rate and pressure drop, how can operating conditions of standard pumps be determined? The point of pump operation on the pump curve will be dictated by piping system characteristics. Pump operation cannot be divorced from the piping system. Pump flow must exactly equal system flow. Pump head must exactly match system pressure drop.

After design, the piping system size is fixed. For any proposed water flow rate, a definite pressure drop will result. Calculation of system pressure drop at design flow rates considers one such condition. Individual pressure drop calculations could be made for each of a large number of other proposed water flows. A curve, called the *system curve*, and illustrating the change in system piping pressure drop due to change in system flow, can be plotted from these calculations, Mr. Carlson stated.

Individual pressure drop calculations are not necessary to plot the system curve. One curve point has already been provided; i.e., pressure drop at design flow rate. The curve can be easily plotted by using this point and observing that pressure drop in a fixed piping system varies approximately as the square of the change in flow rate. He presented the following formula defining this statement:

$$H_1/H_2 = (Q_1/Q_2)^2$$
$$H_1^{1/2}/Q_1 = H_2^{1/2}/Q_2$$

where:

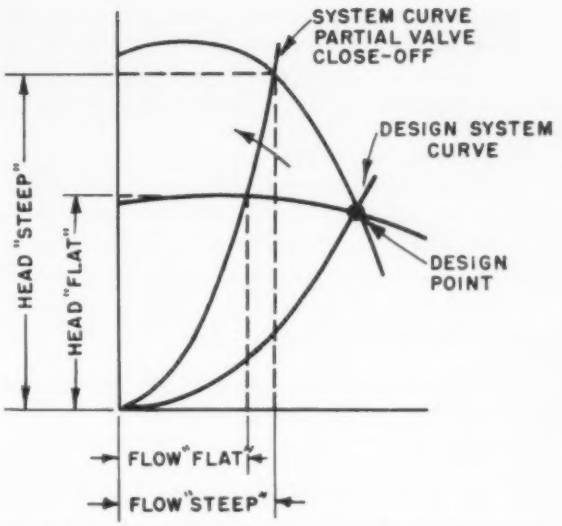
H_1 = Calculated system pressure drop at design flow Q_1
H_2 = System pressure drop at assumed flow Q_2

When the system curve is plotted on a pump curve, the intersection of the pump curve with the system curve is the point of pump operation for that particular pump on the particular piping system described by the *system curve*. It is the only point at which pump head equals

system head and pump flow equals system flow, stated Mr. Carlson.

When a system curve is plotted on a family of pump curves, the intersection of the system curve with the pump curve determines the pumping point for each pump of the series.

A typical system curve, based on a design flow rate of 200 gpm and a system pressure drop of 50 ft, is plotted against a family of pump curves. Such a plot provides the engineer with a great variety of pumps from which to make a final selection. He knows the water flow rate each pump will provide. He can determine which pump will be most economically satisfactory by assessing how heat transfer, system response time, piping noise, piping air elimination, and other factors which will be affected by each pump. By his knowledge of the pump curve, he can provide against motor overloading and select the particular pump most consistent with control objectives, as shown in Fig. 3. He can also determine how each pump will change the system pressure due to its operation.



5 FLAT CURVED pump more closely approximates control objectives than does steep curved unit. This consideration is most important on hydronic systems using valves for control of individual heat transfer units. As valves close, or modulate water flow through remaining open valves, pressure drop across valves and pump head all change. This is illustrated above, for system using two-way valves

Pick Standard Pump to Meet Objectives

The engineer should select the most economically desirable standard pump which will meet overall design objectives, Mr. Carlson stressed. This procedure can be followed only if use is made of the system curve, he said.

Most water-to-air heat transfer units are much more limited in their ability to transfer heat from the unit to the air than in their ability to pick up heat from the water. "Outside" heat transfer from the unit to the air generally limits and controls overall heat transfer. It's like a four lane highway leading to a narrow country road, he said. The country road would limit overall traffic in the same way that the outside coefficient of heat transfer limits overall heat transfer.

Many hot water systems are designed using conventional radiation. Water flow rates have little effect on heat transfer of these units. The principal controlling factors are unit size and mean temperature difference between the water and air. Mean water-to-air temperature difference is really only affected by unit water temperature drop. A considerable change in water flow rates is necessary before the temperature drop across the unit becomes enough to seriously affect heat output for usual design conditions. This fact permits considerable latitude in pump selection for these systems.

For example, assume a conventional design temperature drop of 20 F deg in a two-pipe hot water system using cast iron radiation having a design heat load of 2 million Btu per hr. Design flow rate is then 200 gpm and system pressure drop is 50 ft. The system curve is plotted as in the foregoing system curve-pump curve illustration. What is a logical selection?

Pumps Nos. 1, 2, 3, 4, 5, 6, and 7 can be considered in selection. Operating flow rates, pump heads, installed motor horsepower, and actual system temperature drops at design load for each are shown in the table that follows. Actual design temperature drop for each pump is determined by observing that temperature drop varies in inverse proportion to flow for a given design load.

Pump	Pump flow, gpm	Pump head, ft	Installed motor horsepower	Actual design temperature drop, F deg
Design	200	50	-	20
No. 1	175	40	3	22.9
No. 4	185	42.5	3	21.6
No. 2	180	41	5	22.2
No. 6	215	56	5	18.6
No. 3	190	44	7½	21.0
No. 7	240	73	7½	16.6
No. 5	210	54	10	19.0

At first, the most logical selection would seem to be No. 5. This pump is next largest, is directly over the design point, and is a desirable flat curved pump. It will provide a temperature drop of 19 F deg at design conditions. This change in temperature drop from 20 F is inconsequential. Assuming the initial design radiation selection was based on a 200 F mean water temperature, the 200 F water temperature (mean) design condition would be met by decreasing the supply water temperature only ½ F — an impractical control consideration. The pump could be used, but it is the largest and most costly pump illustrated in the table.

Pump No. 7 will provide greater flow at less installed horsepower. For this reason it may be thought the better selection. But it is not. Increased pumping head and flow rates means more operating horsepower than the No. 5 pump. The increased flow does not add a safety factor; it only increases noise possibilities. The only effect of this pump will be, theoretically, to decrease the required supply water temperature at design load about 1.7 F under the initial design supply water temperatures. This is inconsequential.

Pump No. 1 is a logical selection for the system. Its selection point is about midway on the pump curve and on the flat portion of the curve — not at its end, as with the No. 4 pump. No. 1 is the smallest and least costly of those listed. Yet, it will perform as well in meeting system design objectives. Use of this pump means only a theoretical difference from design assumptions; supply water temperature will be increased about 1.5 F over that initially assumed. This is not enough to make any difference, he said.

Water Flow Rates Very Important

Water flow rates become increasingly important as unit-to-air heat transfer surfaces are extended, Mr. Carlson continued. When extended surface, forced convection, air handling units are used, the water flow rates can be very important in overall heat transfer considerations. This is because forced convection allows easier transfer of accumulated heat from the unit to the air. The outside coefficient of heat transfer, due to water flow rates, has greater effect. Even with these units, however, appreciable flow variations are usually required before heat transfer is seriously affected — provided that unit water flow conditions do not change from turbulent to laminar.

Knowledge of the actual water flow rate provided by the pump assists in evaluating piping noise factors. The effect of water velocity rates on piping air elimination can also be determined.

Likewise, knowledge of system flow rates for the specified pump is required so that the engineer can determine the time for water to flow through the system. This will help determine whether system response to changing load conditions will be adequate with on-off pump operation or if continuous pump operation is necessary.

Mr. Carlson defined pump curves as either flat or steep. The definition is illustrated in the pump curves shown in Fig. 4.

Generally speaking, flat curved pumps are preferred for hydronic systems, he said. This consideration is most important on hydronic systems using valves for control of individual heat transfer units. As valves close, or modulate the water flow through the remaining open valves, the pressure drop across those valves and the pump head all change. This is illustrated in Fig. 5 for a system employing two-way valves. The different system curves for various conditions of valve close-off and system flow are shown. As will be noted, the flat curved pump more closely approximates control objectives; that is, it provides least system head change and greatest system flow change as individual control valves close. It should also be noted that for a system using two-way valve control, the system curve shifts "up" on the pump curve as valves close.

The use of flat curved pumps is preferred to steep curved pumps, he said. Even a flat curved pump on a system of this type does not completely solve the basic problem, however. Secondary pumping control methods offer a simple, easily designed solution which will often reduce total operating pump horsepower.

When three-way valve control is used for heat transfer elements, the shift in the system curve is "down" on the pump curve as the valves open and bypass water past the unit. This is because the design *selection point* is usually based on full flow and, consequently, maximum pressure drop across the heat transfer unit.

As the valves open to bypass, flow through the unit decreases, causing a decrease in pressure drop. At 50 percent unit flow, pressure drop through the unit will only be one-fourth that at full design flow. The change in system pressure drop at partial load conditions results in a "downshift" on the pump curve. Under certain conditions, especially when bypass balancing valves are not used, the downshift could cause motor overloading for pumps powered only to the design point and may cause mechanical pump problems due to cavitation.

Pump Power Needs Are Greater than Theoretical

Power is needed to pump water. Water horsepower is the theoretical horsepower required to pump water at a certain rate against a given pressure head. It is flow rate $\times$ head converted to horsepower.

Actual pump power needs are greater than theoretical water horsepower requirements; power is used in the pump bearings and there are other inescapable losses requiring power usage. The power needed to drive a pump generally increases with the flow rate. Dividing theoretical water horsepower requirements by actual power usage provides pump efficiency.

Most standard pumps are designed to operate at a maximum efficiency about midway on the pump curve. It is not good engineering sense to select a larger than necessary pump over a smaller, but adequate pump on the basis that the larger pump — as a pump — is more efficient. Actual operating costs will usually be higher for the oversized pump. Quiet operation at least cost is the design objective, not pump efficiency in itself, Mr. Carlson emphasized.

The motor used to drive the pump must be equal to, or greater than, the pump power requirements for the operating point determined by the system curve. If not, the motor will overload since the pump will try to draw more power than the motor can safely supply.

A non-overloading pump-motor combination means that the motor is large enough so that it will not overload, if the operating point is on the pump curve.

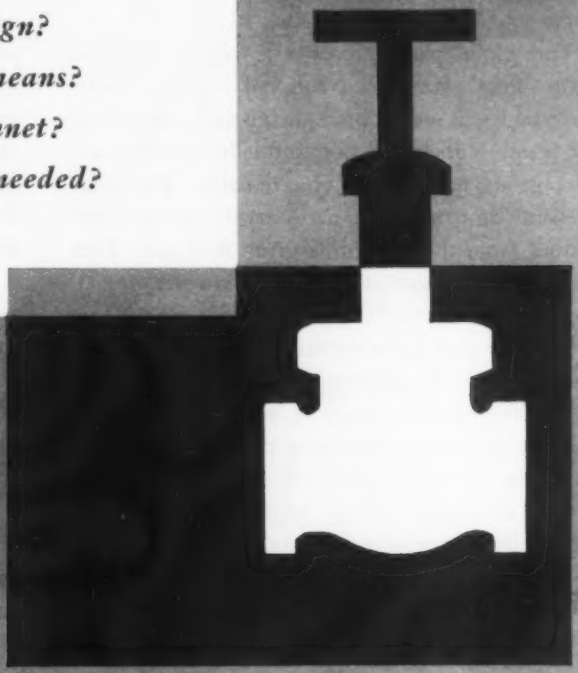
Non-overloading motors are usually larger than motors selected for a specified operating point. This does not mean that operating horsepower for a non-overloading pump-motor combination is greater. For the same operating point and efficiency, operating power will be the same. A non-overloading motor gives the engineer an important safety factor against system shutdown due to motor failure or due to overload protection device operation. This is most important on unattended systems, he concluded. ∓

HPAC ENGINEERING DATA FILE

What to Consider When Selecting Globe and Gate Valves

- *Where are they used?*
- *What seating design?*
- *What operating means?*
- *What type of bonnet?*
- *When is gearing needed?*

By Carl A. Dopp



Globes and gates are the two most commonly used types of valves in power and process piping systems. Each is suitable for a particular service — globe valves for throttling or flow control, gate valves for stop or shut-off service. Each is made in a number of designs to satisfy the requirements of the many different services encountered in power and process piping systems. Selection of the proper seating design, operating means, and bonnet connection is essential for satisfactory valve performance. Failing to consider these components in design and selection may result in expensive valve maintenance or replacement. Information on the selection of gate and globe valves and their important components for successful application is presented in this report.

Other considerations (applicable to all types of valves) are standards, ratings, markings, and the specification of special materials. A discussion of these items is also presented in this report.

The author — who is a member of HPAC's board of consulting and contributing editors — has assembled this information from many sources, starting with his own wealth of experience based on 40 years with Crane Co., where he was directing engineer in charge of the valve and fittings department from 1935 to 1953. Consulting engineers who are designing, and contractors who are installing, piping systems every day were interviewed. Their opinions and comments weighed heavily in the preparation of this material.

In the January HPAC Engineering Data File, the author discussed the general service factors to be considered when selecting valves of all types. Among those considered were temperature, pressure, fluid handled, pressure drop, and frequency of operation. The types of end connections available, suitable gaskets for flanged end valves, and the types of body materials usually used were also discussed, and pointers for proper application were given.

Where Are Globe and Angle Valves Used?

Globe valves are intended principally for throttling service. They are made in the globe, angle, and "Y" pattern designs.

The globe pattern creates a higher pressure drop than other conventional valves. Since throttling is a means of reducing and controlling the pressure, the restriction to the flow is often advantageous rather than objectionable. The high pressure drop makes it necessary to lift the disc farther from the seat for a given flow rate. This reduces the danger of cutting ("wire-drawing") the seating surfaces.

When it is at times necessary to have full flow, the angle or "Y" pattern designs are preferable. These two designs create a substantially lower pressure drop than the globe pattern valve. The "Y" pattern is shown in Fig. 1.

One advantage of the angle valve over the globe valve is that it can generally be located so as to replace an elbow, thereby eliminating one turn in the line.

Globe valves can be opened or closed much faster than gate valves because of the shorter lift of the disc. When valves are to be operated frequently or continuously, a regular globe valve provides more convenient operation than a gate valve. The seating surfaces of a globe valve are less subject to wear and the discs and seats are easily replaced. Also, there is considerably less wear on the female threads in which the stem threads operate. A sliding stem globe valve, as shown in Fig. 2, is frequently used in such cases.

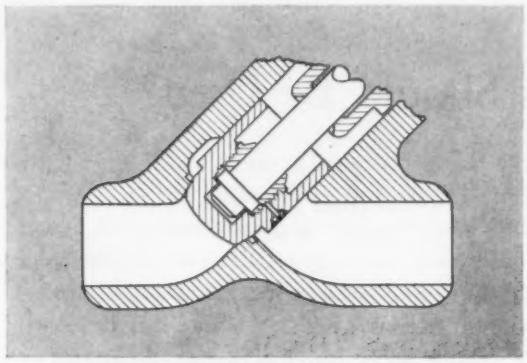
When specifying large or high pressure globe valves, the use of *gearing and bypasses* should be considered. More details on gearing and bypasses are presented in a later section of this report.

Hammer-blow hand wheels on large, high pressure, steel globe valves will often make gearing unnecessary. They are well worth considering for 3 in. and larger valves of the 1500 lb class.

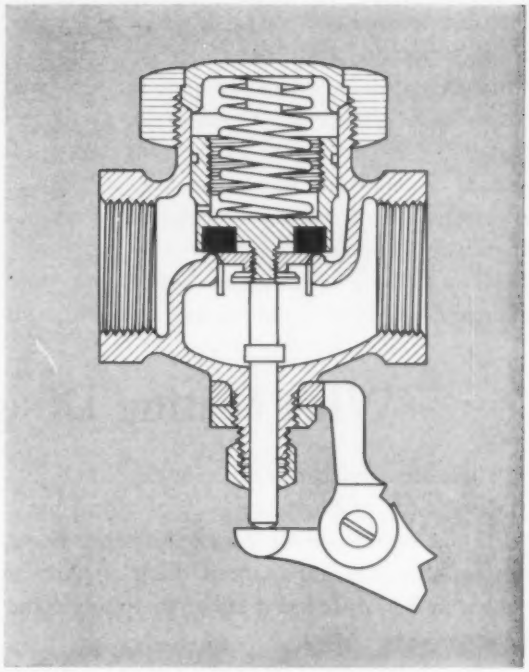
Face to face and center to face dimensions of flanged iron body and steel globe and angle valves have been standardized by ASA B16.10. Steel valves with ring joints, and welding end steel

valves are also covered in the standard.

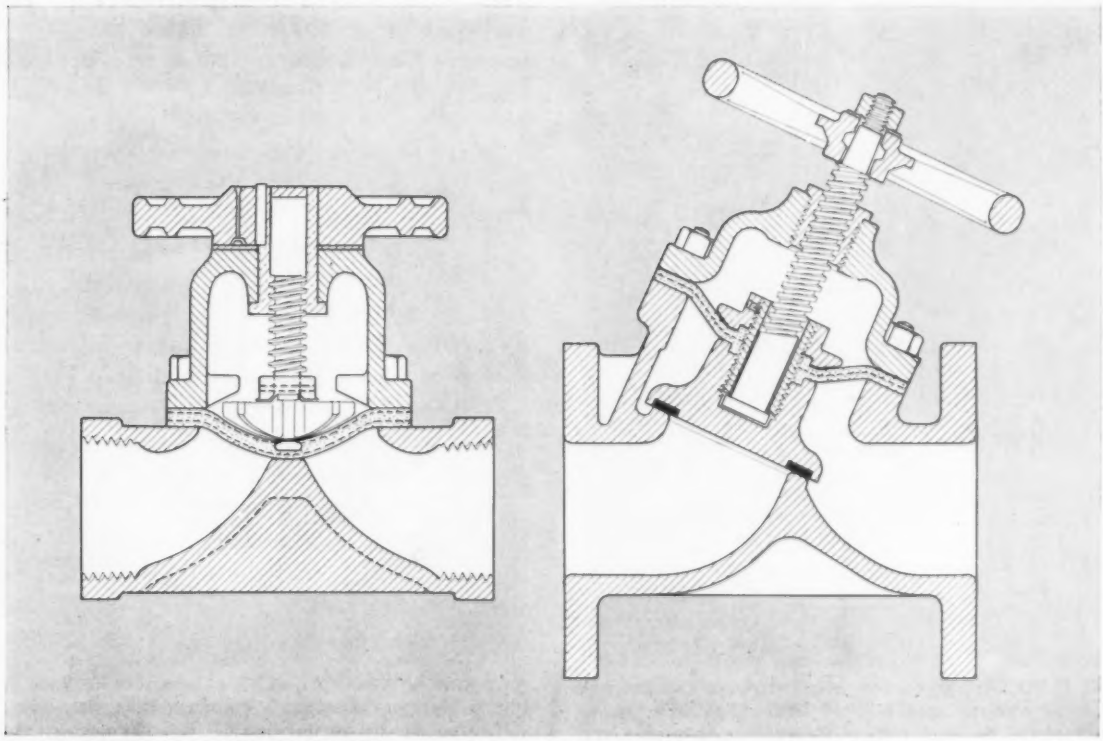
Iron body *diaphragm valves* are basically of the globe type. The main difference is that the stuffing box is eliminated and replaced by a pliable diaphragm. They are regularly made in two types. One uses the diaphragm in place of a disc, and the other has a separate disc. These types are shown in Fig. 3. Diaphragm valves are so designed that



1 "Y" PATTERN DESIGN GLOBE VALVE shown here and angle pattern globe valves are used when full flow is desirable. Both designs have considerably lower pressure drop than the globe valve



2 SLIDING STEM GLOBE VALVE illustrated here is used when frequent or continuous operation of valve is required. Globe valves are suitable for such service as they can be opened and closed quickly due to short lift of disc



3 IRON BODY DIAPHRAGM VALVES are regularly made in the two types shown here. Diaphragm in valve on left is used in place of a disc and that on right has a separate disc. In both types the diaphragm replaces the stuffing box and packing

they can be lined with various types of plastic material, rubber, or synthetics. They also are made with numerous special diaphragms for resistance to corrosive conditions. Whenever a valve is required for service where stuffing box leakage is serious or dangerous, diaphragm valves should be considered. These valves are especially suited for high vacuum applications.

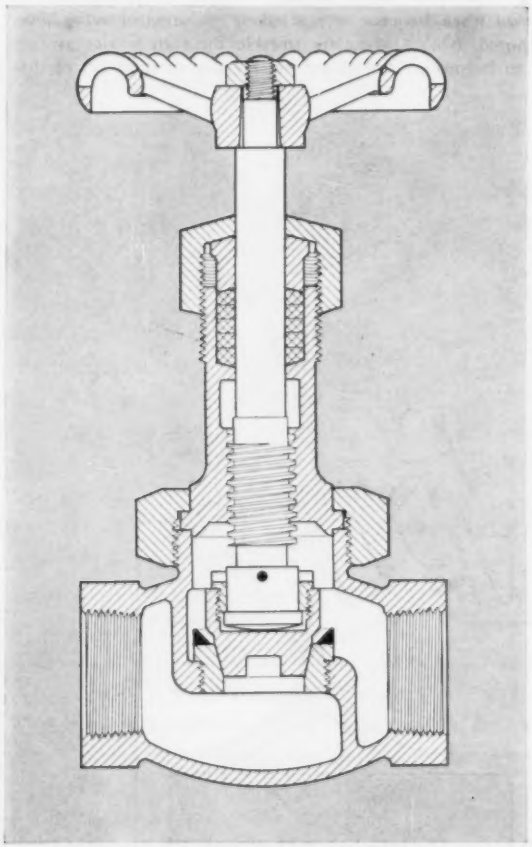
Many of these valves are made with power operators. These include electric and air motors and sliding stems with pneumatic or hydraulic operators. Various combinations of these enable innumerable automatic control systems to be used with them.

Another type of diaphragm valve made in small sizes and of bronze, is similar to the globe type but uses a metal diaphragm between the disc and stem instead of a stuffing box. These valves are used for low pressure gas service and controls, and especially in refrigeration applications.

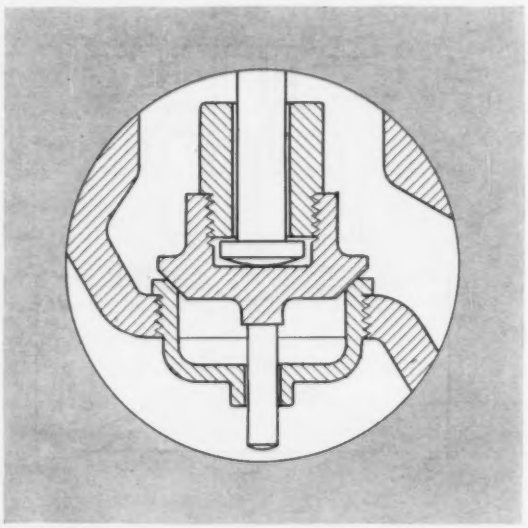
What Seating Designs Should Be Used?

There are a number of different designs of discs and seats for globe valves, each of which has a particular advantage. Of the regular conventional designs the most important is the *plug disc,* as shown in Fig. 4. It has a rather sharp angle and the seating surface is quite wide. It will give long and satisfactory throttling service. The effect of "wire-drawing" is greatly minimized because this cutting action always starts on the outer edges of the seating surfaces. Indentations caused by foreign matter must be large before they can extend across the entire width of the seating surface and create leakage.

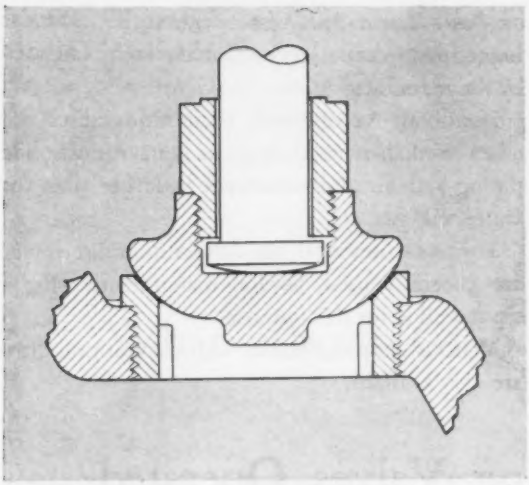
The gradual increase or decrease of the area between the disc and seat surfaces when opening or closing the valve seems to reduce the cutting tendency of the fluid, and provides close throttling control. There are, however, some throttling services which are so severe that special designs are necessary. Two of these conditions are boiler feed control and surface blowdown.



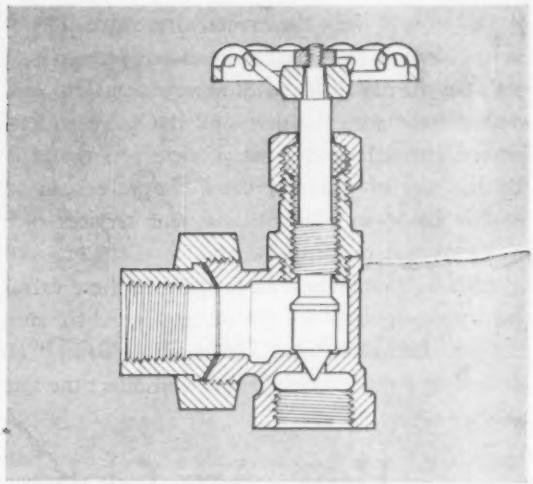
4 PLUG DISC shown here is one of several disc and seat designs regularly used in globe valves. The wide seating surface and the sharp angle of the disc face makes this type especially suitable for throttling service as effect of "wire drawing" is minimized



5 NARROW CONICAL SEAT globe valves are made in two designs, one of which is illustrated here. The seating surface on the disc of this type has the same angle as the body seat. The other type of narrow conical seat is shown in Fig. 6



6 "BALL-TO-CONE" type narrow conical seat design for globe valves is shown here. Disc seating surface is curved in contrast with flat seat of design shown in Fig. 5



7 NEEDLE VALVES of type shown here are used for close throttling control in industrial processes. These valves are sometimes referred to as expansion valves

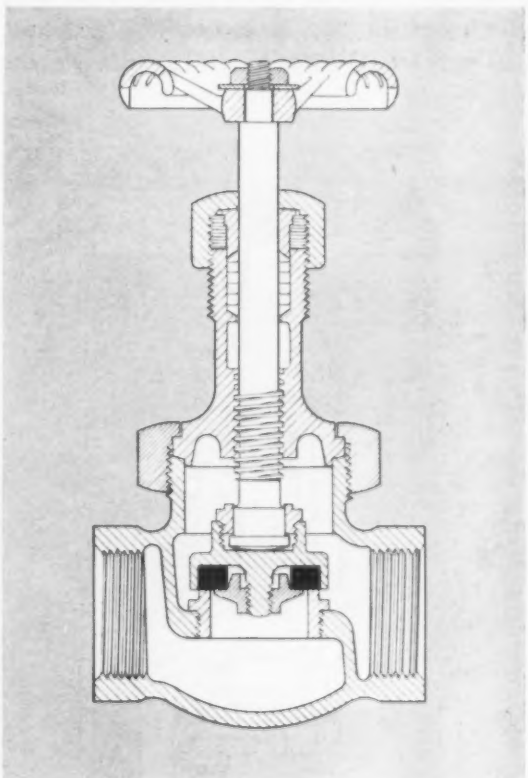
There are two designs of narrow conical seat globe valves. One, shown in Fig. 5, has a seating surface on the disc with the same angle as that on the seat. The other has a conical seat and a curved surface on the disc, sometimes called "ball-to-cone," as shown in Fig. 6. When these narrow seat valves are infrequently operated and are not subjected to severe throttling conditions, they prove quite satisfactory.

The *narrow seat* does not resist wire-drawing nor the damaging effect of hard particles as does the plug disc. If leakage starts, the seats can be reground and made tight with comparatively little effort, provided the valve has not been neglected until the seats are badly damaged.

The *ball-to-cone seat* design is quite popular in large steel valves for high temperature oil vapor service. By proper operation, which involves repeated seating and unseating, a coke deposit on the seats can be cracked and washed away.

Needle valves (Fig. 7), sometimes referred to as expansion valves, are used for very close throttling control such as is necessary in many industrial plants. With iron body and bonnet and special discs they are used for ammonia refrigeration service. When made of brass or steel they are suitable for various services where close throttling is required. The disc is generally made integral with the stem and has a sharp point which fits into a reduced area seat opening.

The bronze *composition disc* design globe valve



8 BRONZE COMPOSITION DISC GLOBE VALVES of type illustrated here have proven to be easily maintained because disc is easily replaced. A wide range of service conditions can be met by different composition discs

(Fig. 8) has proven to be easily maintained because the disc can be replaced with minimum effort. Other advantages are: (1) Requires less

power to seat tight than metal disc valve. (2) It is less likely to be damaged by dirt or foreign matter than the metal disc with narrow seat. Dirt may embed itself into the disc, and the valve will remain tight unless the dirt particle is large. (3) By the use of different discs, the valve can be readily made suitable for different services such as steam, water, oil, air, or gas.

Although some users have operated these valves for throttling, they are not recommended for such service. Expansion and contraction of the disc caused by temperature changes will affect the rate of flow. These discs should never be used for higher temperature service than that recommended by the manufacturer.

Iron body valves with composition discs are often used in sizes as large as 3 in. for gasoline piping systems and sometimes in larger sizes for water, oil, gas, etc.

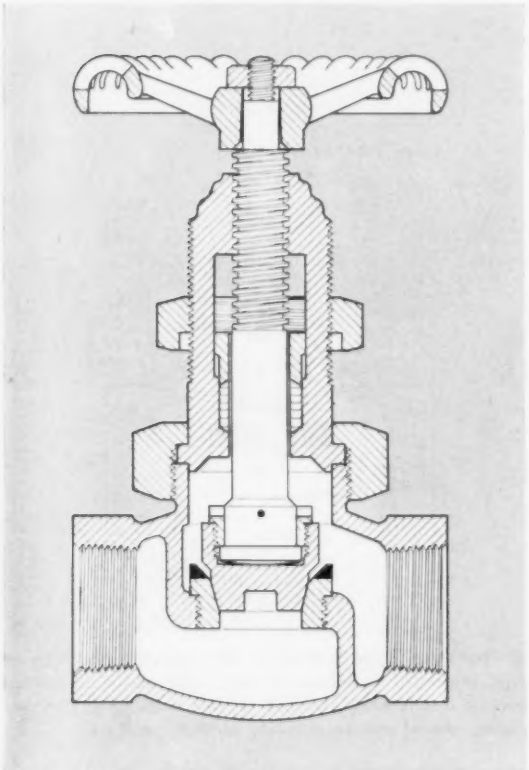
For transformer oil, the composition disc valves are generally used. Several manufacturers list a separate line for this purpose.

Vent or sampling valves with composition discs are also available.

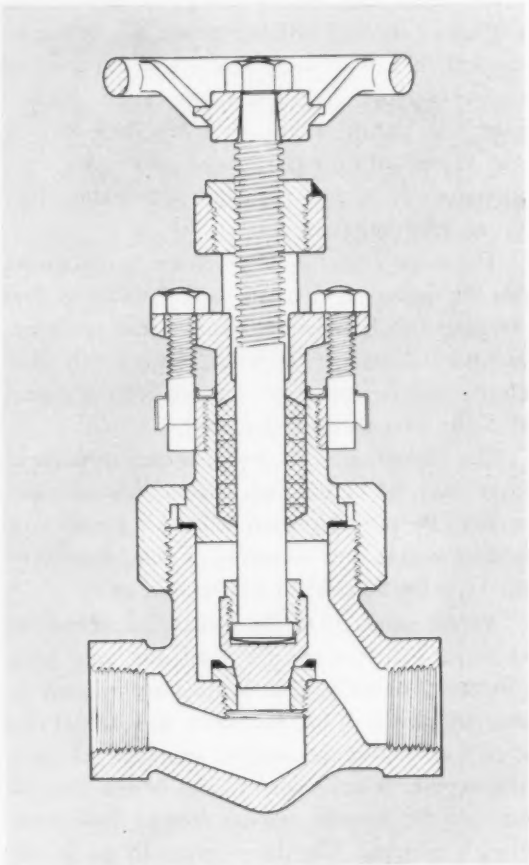
How Are Globe Type Valves Operated?

Globe type valves are made with several different operating means. The *inside screw, rising stem* valve shown in Fig. 4 is common for small size valves, in brass or bronze, iron, and steel.

The O S & Y design in small sizes is generally made in bronze as shown in Fig. 9. The valve shown is one designed to comply with the speci-



9 O S & Y operating means of type shown here are generally used for small bronze globe valves. Stem threads are located out of fluid stream and, therefore, are not affected by fluid. The bonnet of the valve shown is of the union type



10 STEEL VALVES WITH O S & Y operating means are made in the design shown in small sizes. Bonnets of these valves may be either bolted or of the union type illustrated here

fications of the American Association of Railroads (AAR). A similar design is used by some manufacturers for small steel valves. A more recent O S & Y design for small steel valves is shown in Fig. 10. These valves are regularly made with either bolted or union bonnet connections.

The design shown in Fig. 11 is commonly used for large globe type valves in all metals. When specifying globe valves for fire protection lines always include the term "Underwriters' Pattern."

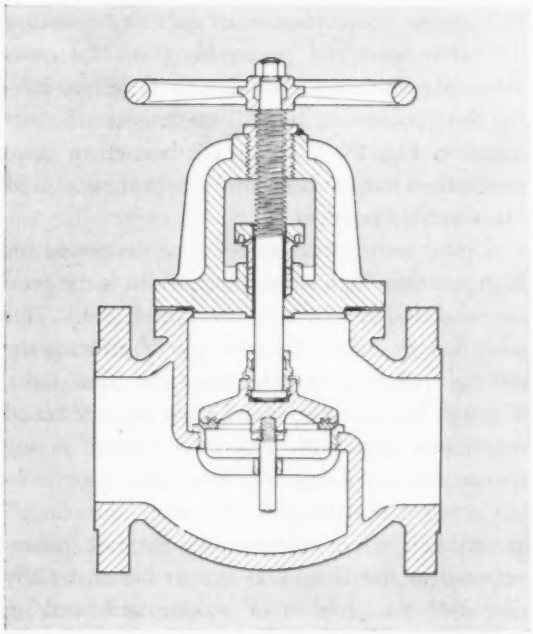
What About Globe Bonnet Connections?

The body and bonnet connections of globe valves are made in different designs, namely: (1) threaded, (2) union, (3) bolted, (4) welded, and (5) pressure-seal.

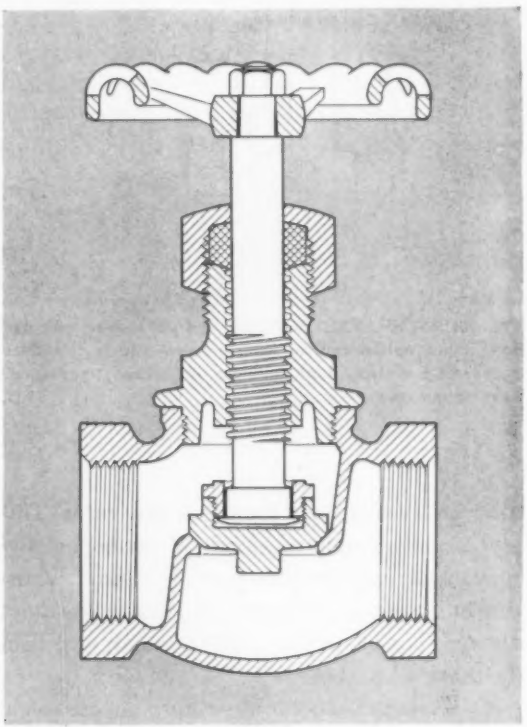
Small brass valves for low pressure service are generally made with *threaded bonnets* as shown in Fig. 12. They are economical and very compact. If the body and bonnet are frequently taken apart there may be a danger of galling their seating surfaces when tightening the bonnet with a wrench.

Some small steel valves are made for high hydraulic pressures with this type of bonnet. Because of the strength of steel they can be designed sufficiently strong for the service.

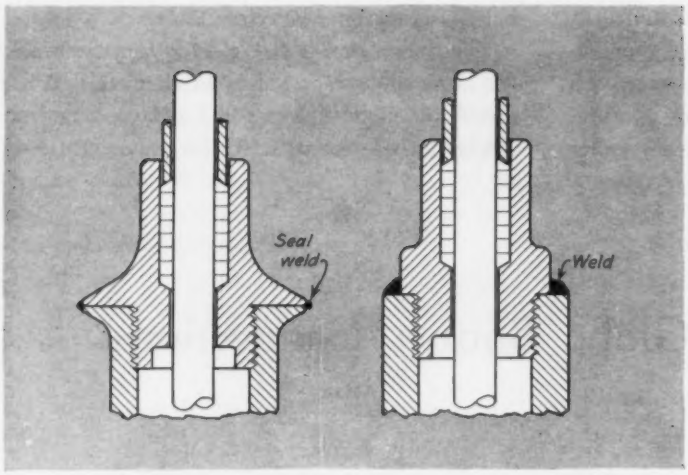
Union bonnets are regular on many small ferrous and nonferrous valves. The body is reinforced by the union ring to resist internal pressure. This is illustrated in Fig. 9. When assembling the



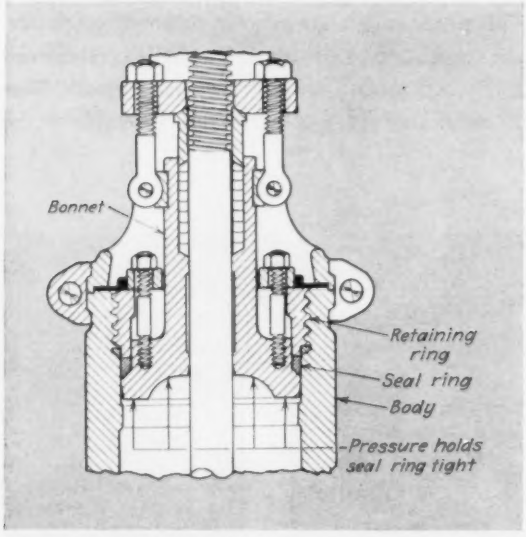
11 O S & Y DESIGN shown here is commonly used for large globe valves in all metals. Valve shown has bolted bonnet which is typically used on large globe valves. Bolted bonnets are often used on valves as small as ½ in. for some services



12 THREADED BONNETS like one shown here are used on small brass valves for low pressure service. Care should be taken when tightening bonnet with a wrench to prevent galling of the contact surfaces between the body and bonnet



13 WELDED BONNETS similar to those shown here can be used on steel valves. In small sizes this type of bonnet has been satisfactory for high pressure and high temperature steam service. Numerous bonnets of this type have been developed — two of which are shown here — to cope with problems of removal and assembly when disc repairs are necessary



14 PRESSURE-SEAL BONNET design shown here has been found satisfactory for high pressure and high temperature steam service. Line pressure is utilized to maintain tight bonnet connection

body and bonnet, only the union ring turns. This prevents any tearing or galling of the bonnet and body metal. It is therefore possible to safely disassemble the valves frequently if necessary, without damage. The union has a better wrench grip than the threaded bonnet.

Valves larger than 2 in. require an extremely large wrench and for that reason, very few union bonnet valves are made in larger sizes.

Bolted bonnets are used on practically all types of large globe valves, as shown in Fig. 11. In some cases, such as in chemical piping applications, bolted bonnets are specified in sizes as small as ½ in. and sometimes even smaller. These joints can be easily taken apart or reassembled with a much smaller wrench than other joints like the union bonnet or threaded joint.

Obviously the *welded bonnet* can be used only on steel valves. In small sizes this joint has been most satisfactory for high pressure and high temperature steam. The real problem encountered with the welded bonnet is the difficulty of taking the valve apart and reassembling it. Numerous valve manufacturers have developed designs having this problem in mind. Two designs are illustrated in Fig. 13. Welding the bonnet on large steel valves has not been very practical because of this assembly problem.

A most satisfactory bonnet joint developed for high pressure, high temperature steam is the *pressure-seal* design which is shown in Fig. 14. This joint is designed on the principle of utilizing the internal pressure to help keep the joint tight. Through laboratory tests and many types of actual service for years with superheated steam piping systems, the joint has remained tight when subjected to severe quenching. The term "quenching" as used here refers to any sudden decrease in temperature in the line. This design has materially simplified the problem of making and breaking the bonnet joint in large high pressure, steel valves. The time required to perform this operation is many times shorter than that required for bolted bonnets.

Where Are Gate Valves Used?

Gate valves are intended for use as stop valves. They give the best service when used in the wide open or fully closed positions.

The gate pattern has the lowest pressure drop of any regular type of valve. When in the open position, the enlargement of area in the body into which the disc fits causes the pressure drop to be only slightly greater than that in an equal length of pipe.

Gate valves should not be used for throttling except in an emergency. The nature of their design makes them impractical to control flow with any degree of accuracy. The disc usually has no rigid connection with the stem and is loosely guided to permit seating without binding. When the disc extends into a high velocity stream, it is likely to vibrate. The double disc seating arrangement is particularly apt to vibrate. Vibration of the disc can result in excessive wear of the parts and can sometimes set up damaging vibration in the line. Also, when in the partly open position, the disc and seat faces are so close to each other that serious cutting ("wire drawing") of the seating surfaces will likely result.

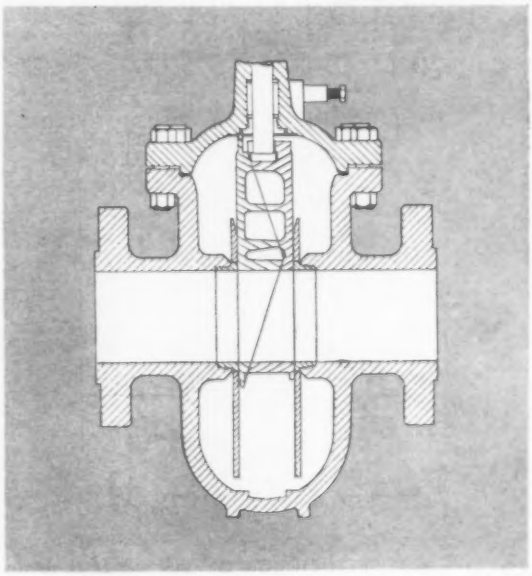
Recent gate valve designs for pipe lines are based upon the principle used for many years for large hydraulic valves. The disc has an extension which slides into a large pocket in the bottom of the valve when closed. This extension has a circular port the same diameter as the body seat port. The body and disc seating surfaces are parallel. When the valve is open, the body and disc extension form a straight passage through the valve as shown in Fig. 15. Valves of this design are often called *conduit* or *pipe line* valves. The pressure drop is the same as that in an equivalent length of pipe or conduit. Although these valves are called pipe line valves they should give excellent service in large hydraulic lines.

The conduit design is ideal for pipe lines particularly if it is the intention to clean the line with "scrapers" or "go-devils". The cleaning device will pass freely through the valve, and the disc design prevents settling of sediment in the bottom of the valve body. Some of these valves are provided with means for filling the valve body and bonnet with grease. This lubricates all internal moving parts, protects the interior of the valve from corrosion, and acts as a seal for the seats.

Standard *face to face* dimensions of flanged ferrous gate valves are given in ASA B16.10. Dimensions are given for both regular and ring joint flange facings. The Standard also covers welding end steel valves.

Bonnet and body connections for gate valves are similar to those for globe valves. The different designs include: (1) threaded, (2) union, (3) bolted, (4) welded, and (5) pressure-seal. A discussion of the various types of body and bonnet connections may be found on page 147.

When specifying large gate valves, the use of gearing and bypasses should be considered for ease of operation. A discussion of gearing and bypasses is presented in a later section. When specifying gate valves for fire protection lines, reference should be made to the term "Underwriters' Pattern."



15 EXTENSION ON DISC of pipe line valve forms straight passage through valve when in open position as shown here. This design is particularly suitable when pipe line is to be cleaned with "scrapers" or "go-devils"

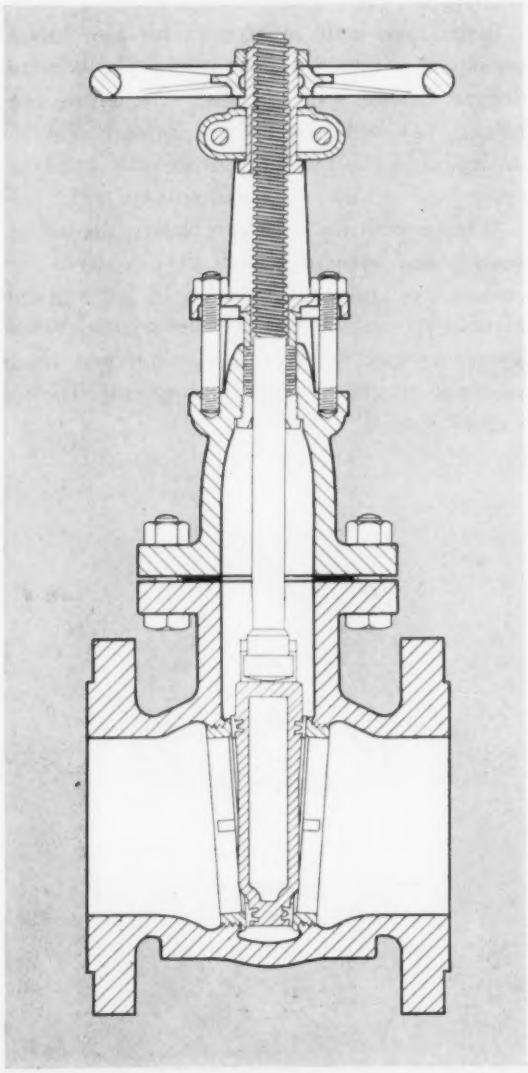
How Are Gate Valves Operated?

Gate valves are made with several different operating means. The O S & Y design, which is shown in Fig. 16, is available in most sizes and metals regularly used for valves. The non-turning, rising stem of this design indicates the approximate position of the disc. Since the stem threads are outside the valve body, they are not affected by the line fluid.

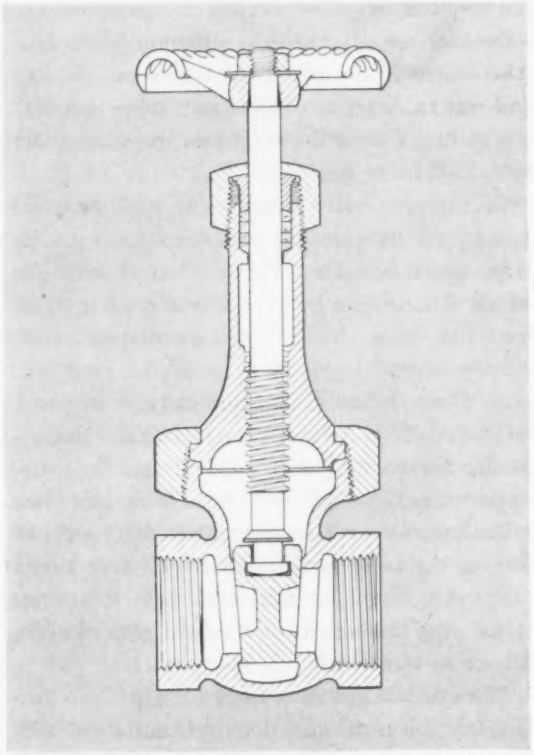
The threads and yoke sleeves of O S & Y type valves can be easily lubricated. In large sizes, the yoke sleeves can be made with ball bearings to minimize friction between the sleeve and yoke collar. Many large steel gate valves are made today with ball bearing yoke sleeves.

The inside screw, rising stem design shown in Fig. 17 is most often used in small iron, and brass or bronze, gate valves. In this type of valve, the stem is threaded into the bonnet. The approximate position of the disc can be judged by the amount the stem projects above the stuffing box. The stem threads are exposed to the fluid in the line. Generally, exposing the stem threads to line fluid does not seem to damage small valves as much as it does large valves.

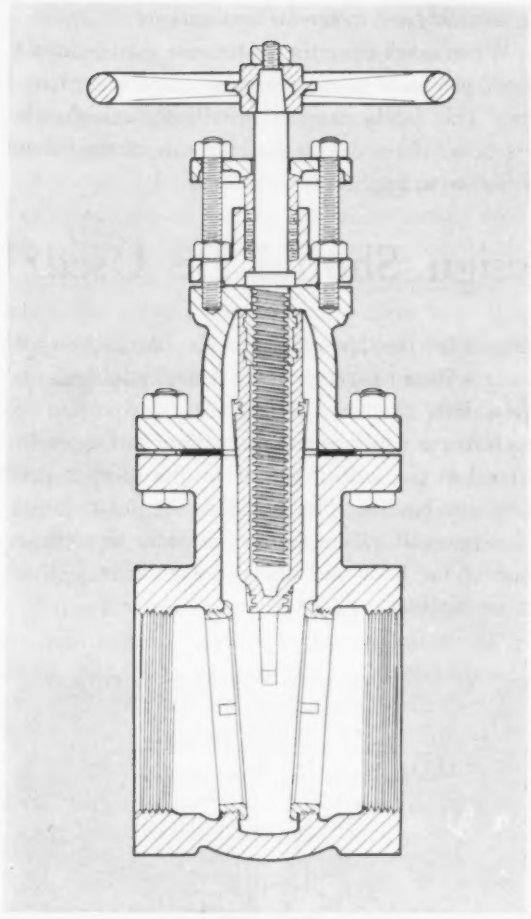
The inside screw, non-rising stem design shown in Fig. 18 is used in both large and small valves. The stems in these valves turn and the threads are exposed to the fluid in the line. The principal ad-



16 O S & Y STEM DESIGN for gate valves is shown here. Stem threads are outside valve body to eliminate harmful effects of line fluid. Non-turning, rising stem indicates approximate position of disc in this type of valve. The valve illustrated has a solid wedge disc



17 INSIDE SCREW, RISING STEM design shown here is common in small iron, and brass or bronze, gate valves. Exposing threads to line fluid is not as critical in small sizes as it is in large sizes. Approximate position of the disc can be estimated from projection of stem above stuffing box



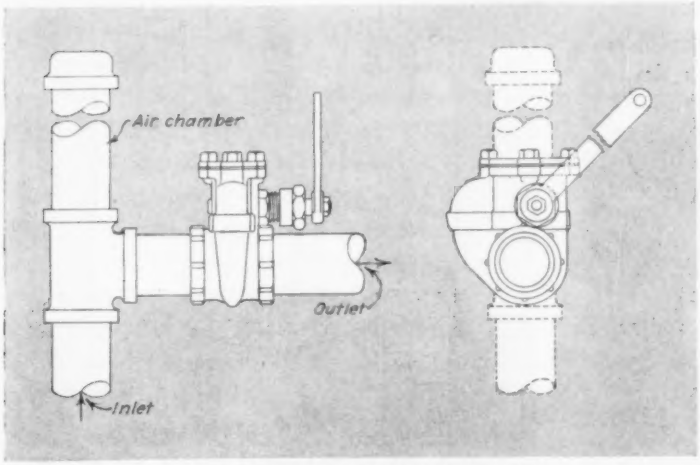
18 INSIDE SCREW, NON-RISING STEM design shown here is used in both large and small valves. Small valves of this design are used for many services, including steam. Sizes larger than 3 in. should never be used for steam or other high temperature service

vantage of valves of this design is that they require much less headroom than the O S & Y type or the other rising stem designs.

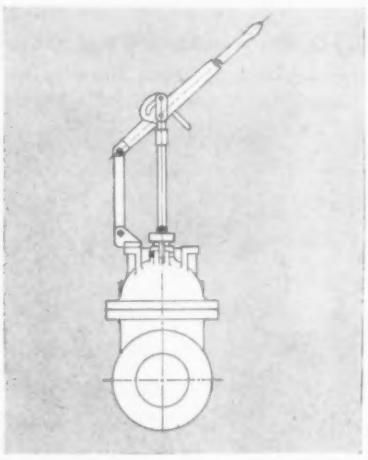
Small brass or bronze, and small iron, valves of this type are used for many services, including steam. Large valves of this design are common in lines carrying fluids at moderate temperatures. Valves of this type in sizes larger than 3 in. should not be used for steam or other high temperature service. The reasons for this are: (1) The stem threads which screw into the disc hub are always exposed to the line fluid. Foreign matter in the fluid can get into the threads and can cause excessive wear, and sticking or jamming. (2) Expansion and contraction of the parts due to temperature changes can cause the threads to bind, which in turn often causes "galling" or "knitting" of the metal.

Since the stem of this type of valve does not rise, it cannot be used to indicate the position of the disc. A mechanical indicator can be used especially for this purpose when required for the intended service.

Quick operating gate valves are regularly made in brass or bronze, and iron. Brass valves of this type are generally made in designs similar to that shown in Fig. 19. The operating lever is connected to the disc by a shaft which projects through the side of the valve. Quick operating brass gate valves are also made with a sliding stem (Fig. 20). They are operated with a lever similar to that used on large quick operating iron valves.



19 BRASS QUICK OPERATING gate valves are generally made in designs similar to that shown here. Disc is operated by lever. Sliding stem shown in Fig. 20 is also used for brass quick operating valves. Air chamber or shock absorber is necessary to avoid water hammer when used in liquid lines



20 SLIDING STEM design shown here is generally used for iron quick operating gate valves and is sometimes used for brass or bronze valves

Iron quick operating gate valves are generally made in a design like that shown in Fig. 20. Some small iron valves are also made with a lever on the side similar to that shown in Fig. 19. These are often used for low pressure "blow-off" valves, particularly on portable boilers such as are used in oil fields and in similar applications.

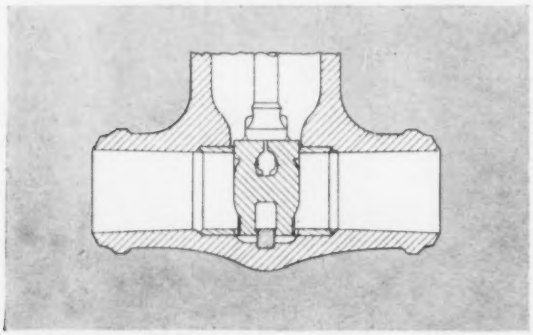
When quick operating valves are used in liquid lines, provision must be made to avoid water hammer. This can be done by installing shock absorbers or air chambers on the inlet side of the valve, as shown in Fig. 19.

What Gate Valve Disc Design Should Be Used?

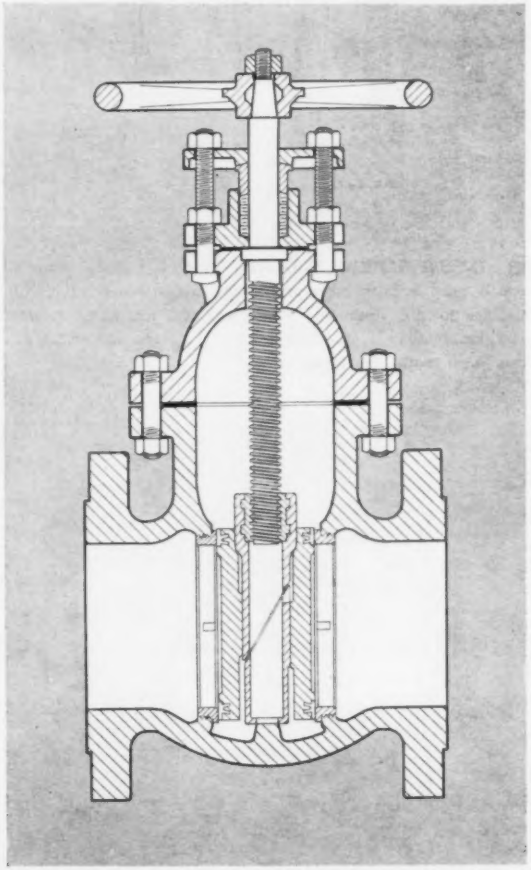
A number of different disc designs are used in gate valves to meet the requirements of different services. The *solid wedge disc* shown in Fig. 16 is used for all services requiring gate valves. In high temperature steam lines, these valves in sizes larger than 3 in. have at times given some trouble with the disc binding.

The continual increase in the temperatures used in superheated steam has created many new problems. One of these is the binding of solid wedge discs. When a gate valve is open and superheated steam passes through it, the body heats up to a higher temperature than the disc. When the valve is closed and contracts due to cooling, the body contracts more than the disc. This results in pinching the disc so tightly that it is sometimes impossible to open the valve. Various methods have been tried to open a valve in this condition. One that has generally been successful is to cool the stem with dry ice. The contraction of the stem that results, applies an opening force which reduces the force that must be applied by the operator to open the valve. At the same time the body is heated from the outside so it will expand.

The most satisfactory way to avoid this problem in superheated steam lines is to use a flexible disc. The *flexible disc* is made like a pair of flanges joined together by a centrally located circular hub, as shown in Fig. 21. The portion of each flange which carries the seating surface is designed to give sufficient uniform flexibility to prevent any binding. Flexible discs are not required in very small valves as the difference in contraction of the body and disc is not great enough to cause binding.



21 FLEXIBLE DISCS like one shown here are used in large valves in superheated steam lines to overcome sticking of disc in body seat. When body and disc cool during time valve is closed, body contracts more than disc, causing solid wedge type disc to bind

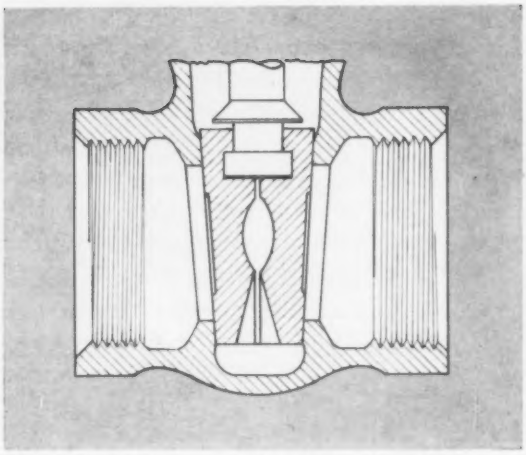


22 PARALLEL SEAT DOUBLE DISC design shown here is used extensively for water and other fluids at moderate temperatures. Large valves of this design should not be used for steam at pressures above 25 psi because of possible vibration and excessive wear

Many high pressure steel gate valves in sizes 4 in. and larger are made with flexible discs for superheated steam service. Discs of this type have also been used in other services and have eliminated some operation problems.

The *parallel seat, double disc* design shown in Fig. 22 is another seating design commonly used in gate valves. The disc seating surfaces are forced against the body seats by a wedge mechanism when the valve is closed. Iron valves with this type of disc are used extensively for water and other fluids at moderate temperatures. Both the *inside screw, non-rising* stem, and O S & Y designs are used. For underground service the non-rising stem seems to be preferred because a long tee head wrench can be readily applied. Also, valves with parallel seat, double discs are more easily repaired than those with wedge discs.

When a parallel seat valve is operated, the outlet half of the disc has a cleaning action as it slides over the body seat. This causes some wearing of the downstream seat. Large parallel seat, double disc valves should not be used for steam service at pressures above 25 psi. High velocities combined with the steam temperatures encountered may cause vibration and excessive wear.



23 DOUBLE WEDGE DISC design illustrated here is most often used in small brass valves but has been used in some large valves

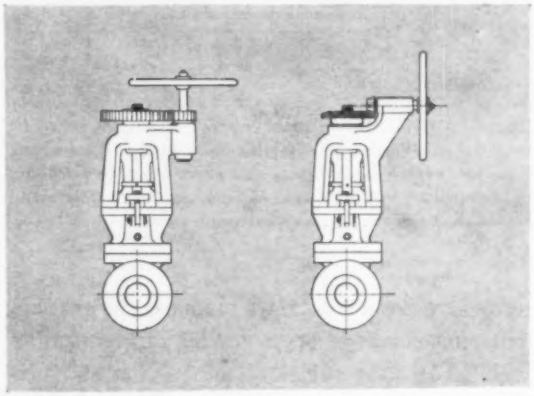
Another type of *double disc* is the *wedge* design shown in Fig. 23. This seating design has been used in some large valves but it is most often used in small brass valves. When designed to be uniformly flexible, steel discs of this type will overcome binding in high temperature service. However, these discs could be subject to undesirable amounts of vibration.

What Type of Gearing Is Used with Gate Valves?

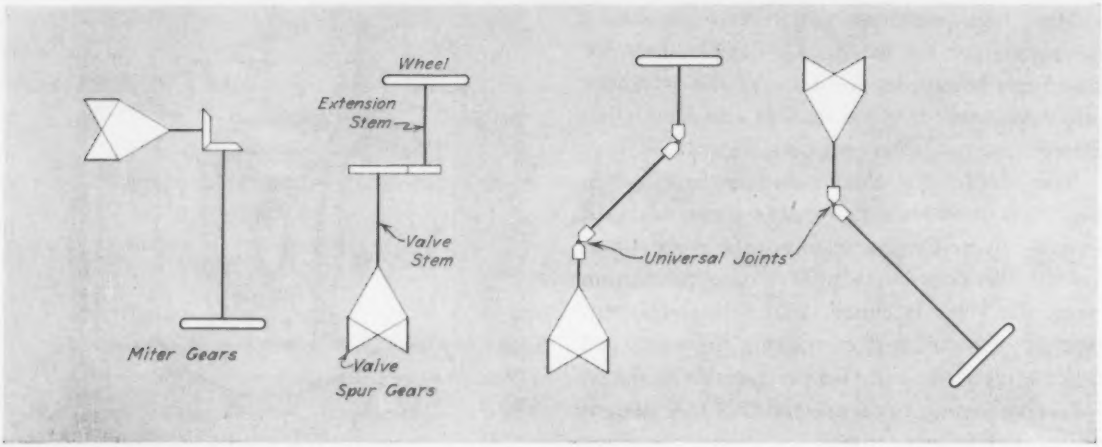
The decision of when and where to use gearing on gate type valves has always been a problem. Oftentimes a large gate valve is installed and it is found that the torque required to operate it is excessive. In such cases it is quite expensive to install gearing. The proper time to consider gearing is during design of the piping system.

There are several reasons for using gearing with gate valves. One reason is for convenience of the operator. It is important that a man operating a valve can grasp the hand wheel in such a manner that he can exert his full strength on it. The location and position of a valve in the line may make it difficult to operate. This should always be considered during design and installation of any valve. By the use of bevel gears, the operating shaft (pinion) may be extended at right angles to the valve stem. This will sometimes overcome the difficulties of inconvenient location. Typical applications of spur and bevel gearing are shown in Fig. 24.

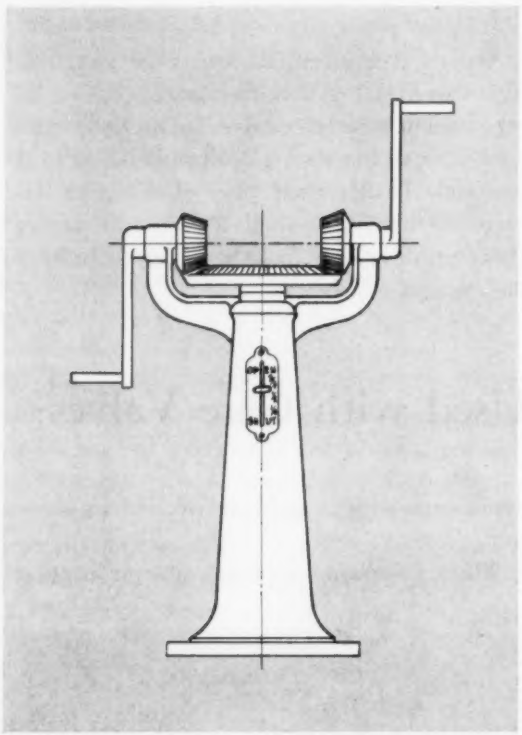
When assembling a geared valve in manufac-



24 SPUR GEARING shown on left and bevel or miter gearing shown on right are used to overcome operating difficulties caused by excessive torque requirements or inconvenient location



25 EXTENSION STEMS provide a simple means of obtaining remote control of a valve, either with or without gearing. Several applications of gears and universal joints are illustrated here



26 GEARING for remote valve operation may be mounted on top of a floor stand similar to that shown here. However, experience indicates that gears or operator should be mounted on valve for ease of operation when floor stand is used in conjunction with an extension stem

ture, there are several ways to mount the gearing. The pinion stem of bevel gearing can be parallel with or at right angles to the valve stem (perpendicular or parallel to the line). If the position of the pinion stem is important, the specifications should clearly state how it should be located.

Gearing may also be employed to permit remote operation of a valve. Sometimes, remote operation is required and an extension stem can be provided for this purpose. If the extension is not in line with the valve stem as installed, gearing may be used to connect the extension and valve stem. Bevel or miter gears can be used for a change in plane and spur gears for an offset in the same plane. Universal joints may also be used for this purpose if gearing is not required to provide the necessary power for valve operation. The sketches shown in Fig. 25 may suggest applications of gearing and universal joints.

If one-man operation of a valve is impossible, gearing may be desirable from the viewpoint of safety and economy. At times, valve operation may be necessary when only one man is readily available. The extra cost of personnel required for valve operation may soon exceed the first cost of gearing.

When large gate valves are to be used for discharging water to the atmosphere, the specifications should state the service conditions. A geared or power operated valve will most likely be selected.

If an extension stem is used in conjunction with a floor stand, the gears or operator should be mounted on the valve. The reason for this may be illustrated by an example from experience. A 20 in. or 24 in. parallel seat, double disc, iron gate valve was used as a so-called "blow-off" valve for a city water reservoir. This valve was installed in a pipe line which ran through a hill from a point near the bottom of a man-made lake used as

the reservoir. The purpose of this pipe line was to wash out the sediment which accumulated at the bottom of the reservoir. The valve was operated through a gear ratio of 6 to 1. The gearing was mounted on top of a floor stand similar to that shown in Fig. 26. The pressure behind the valve was equivalent to a 40 ft head or about 17 psi. Four husky men applied their full strength and made very slow progess in opening and closing the valve. Whether the excessive drag was due to the velocity causing tipping of the disc into the outlet port, or to some other phenomenon was not determined. However, in a similar situation where gearing was originally mounted on a floor stand at the end of a long extension stem, moving the gearing to the valve proper eliminated the difficulty.

Portable power operators are used in many cities to operate valves in water lines. In such cases, it is obvious that gearing is not necessary unless the power operator is not adequate. The use of a bypass to balance the line pressure will often eliminate the need for gearing except for large valves having heavy discs.

When Is Gearing Needed to Operate Gate Valves?

Many factors must be considered to determine when a gate valve requires gearing to reduce operating torque. In general, it is impractical for the designer or installer to make the necessary tests to evaluate torque requirements. The following variables must be considered:

1) The maximum differential pressure at which the valve will be operated. This is frequently the maximum working pressure.

2) The fluid temperature at which the valve will be operated. The power required to operate valves is not significantly affected by temperature in the range for which iron valves are rated. However, the temperature range is so broad for steel valves that significant changes in friction of moving parts have an appreciable effect upon the power required to operate them.

3) Hand wheel diameter and the force that an average man can apply to it.

4) Stem diameter, pitch, and lead of threads.

5) Friction created by pressure loading on the moving parts.

6) Average friction caused by the stuffing box packing.

TABLE 1 — STEEL GATE VALVES with solid wedge discs can be operated without gearing by one man when pressure differential does not exceed values given here in psi

Size, in.	150 lb			300 lb			300 lb, with special ball bearing sleeve			400 lb		
	Below 500 F	500 to 750 F	Above 750 F	Below 500 F	500 to 750 F	Above 750 F	Below 500 F	500 to 750 F	Above 750 F	Below 500 F	500 to 750 F	Above 750 F
5	*	*	*	*	610	*	*	*	*	890	670	530
6	*	*	*	620	460	370	*	*	*	690	510	410
8	*	*	*	380	280	230	*	*	*	810†	610†	480†
10	240	*	*	270	200	160	*	*	*	500†	370†	300†
12	160	120	*	190	140	110	*	*	*	350†	260†	210†
14	140	100	85	130	100	80	260†	200†	160†	260†	200†	160†
16	95	70	55	110	80	60	200†	150†	120†	200†	150†	120†
18	80	60	45	75	55	45	150†	110†	90†	150†	110†	90†
20	60	45	35	60	45	35	120†	90†	75†	120†	90†	75†
24	35	25	20	30	20	15	60†	45†	35†	65†	50†	40†

	600 lb			900 lb			1500 lb		
	Below 500 F	500 to 750 F	Above 750 F	Below 500 F	500 to 750 F	Above 750 F	Below 500 F	500 to 750 F	Above 750 F
2½	*	*	*	*	*	*	*	3020	*
3	*	*	*	*	*	*	2950	2210	1770
4	1390	1040	830	1520	1110	890	1880	1410	1130
5	990	740	590	1070	810	650	2710†	2030†	1630†
6	1440†	1080†	870†	1570†	1170†	940†	1730†	1290†	1030†
8	800†	600†	480†	890†	670†	530†	930†	700†	560†
10	480†	360†	290†	520†	390†	310†	570†	430†	340†
12	330†	250†	200†	350†	260†	210†	320†	240†	190†
14	260†	200†	160†	290†	220†	170†	270†	200†	160†
16	200†	150†	120†	220†	170†	130†			
18	160†	120†	95†	170†	130†	100†			
20	100†	80†	60†						
24	60†	45†	35†						

* These valves are easily operated without gearing.

† Ball bearings on yoke sleeve.

7) Weight of the disc in large valves.

The maximum pressure differential at which one average man should be able to operate a gate valve without gearing is indicated in Tables 1, 2, and 3 for several different types. The values given in the table are based upon many tests to determine the effect on torque requirements of the various factors given above. It should be noted that differences in commercially available designs may cause some variation from the listed pressure differentials. Minor variations from the limits given should not be serious.

TABLE 2 — O S & Y STEEL GATE VALVES with flexible discs and pressure seal bonnets can be operated without gearing by one man when pressure differential does not exceed values given here in psi

Size, in.	600 lb		900 lb		1500 lb	
	Below 750 F	Above 750 F	Below 750 F	Above 750 F	Below 750 F	Above 750 F
3	*	*	*	*	2440‡	1710‡
4	*	*	2030	*	2190	1880
5	1070	*	1400	1200	1560	1340
6	810	690	2080†	1330†	2300†	1970†
8	1060†	890†	1160†	990†	1250†	1070†
10	650†	560†	730†	630†	770†	660†
12	460†	390†	470†	410†	500†	430†
14	360†	310†	370†	320†	420†	360†
16	260†	230†	230†	200†	250†	220†
18	190†	160†				
20	130†	110†				
24	70†	60†				

* These valves are easily operated without gearing.
† Ball bearings on yoke sleeves.
‡ Discs in 3 in. and smaller sizes are not flexible.

TABLE 3 — IRON BODY GATE VALVES of types listed can be operated without gearing by one man when pressure differential does not exceed values given here in psi

Size, in.	Solid wedge disc						Parallel seat double discs									
	O S & Y			Non-rising stem			O S & Y					Non-rising stem				
	25 lb	125 lb	250 lb	25 lb	125 lb	250 lb	25 lb	100 lb	200 lb	500 lb	800 lb	25 lb	100 lb	200 lb	500 lb	800 lb
6	*	*	*	*	*	*	*	*	*	*	680	*	*	*	*	*
8	*	*	430	*	*	*	*	*	*	410	410	*	*	*	*	600
10	*	*	240	*	*	340	*	*	160	240	240	*	*	*	350	350
12	*	140	190	*	*	230	*	*	140	180	180	*	*	*	200	260
14	*	100		*	*		*	80	100			*	*	*		
16	*	65		*	100		*	65	60			*	95	95		
18	*	60		*	90		*	60	50			*	90	80		
20	*	45		*	65		*	50	40			*	70	65		
24	30	30		45	40		35	30	30			*	50	45		
30	20	20		30	30		30	20				*	30			
36	**	**		20	**		20	**				25	20			
42	**	**			**		**					**				
48	**	**			**		**					**				

*These valves are easily operated without gearing.
**These valves should be geared, regardless of pressure.

Must Gearing Be Used for Globe Valves?

Globe and angle valves may require gearing for the same reasons as listed for gate valves — convenience, remote operation, and torque reduction. The first two are self evident, but the third (torque reduction) must be considered when the line pressure cannot be balanced. Even with the pressure balanced in extremely high pressure lines (4000 psi for example) the force acting against the lower end of the stem makes it necessary to consider torque reduction when seating the valve.

It can be readily visualized that the minimum stem thrust required to operate a globe valve is equal to the differential pressure times the seat area. If pressure is applied above the seat this minimum force would be required to lift the disc against the pressure force. If pressure is applied under the disc, this minimum force would be required to seat the valve, and some additional force would be required in order to apply the necessary unit loading on the seating surfaces. This unit loading is a variable that depends upon the seating materials, quality of finish, etc.

In the case of a gate valve, the stem thrust required to move the disc is a function of the wedge angle and the friction angle as well as the pressure and the seat area. The stem force required to overcome the pressure load on the disc is equal to the vertical component of the pressure load acting upon this angle. The force required is normally considered to be about three-tenths of the product of pressure and seat area. This value is an approximation of the tangent of the combined angle due to wedging and friction.

Comparing the above values for the two types of valves it can be seen that the stem thrust required to seat or unseat a globe valve is usually about three times that for a gate valve of the same size.

The torque required at the hand wheel to operate

valves can be varied by changing the mechanical advantage between the wheel and the valve stem. This can be done by means of gearing, toggles, ball bearing yoke sleeves, etc.

Operating torque may also be reduced by balancing line pressure by means of a small bypass. With the line pressure balanced there will be no differential pressure on the disc to contend with, and in most cases, gearing will not be required as far as operating torque is concerned.

If the main valve is equipped with an external bypass, it must be remembered that some time will be required for the system to become completely balanced after the bypass is opened. This is also true when the main valve is equipped with an internal bypass. Many large turbine throttle valves are made with an internal pilot and balancing chamber. In these valves, the pressure acting on the disc is quickly balanced.

If the designing engineer has not had sufficient experience on which to base a decision, he should specify complete service conditions and request the manufacturer's recommendation on the need for gearing.

When Should Bypasses Be Used?

A bypass is used for balancing line pressure and for gradual warming up of steam lines. When attempting to perform either of these functions by partial opening of the main valve, the seating surfaces are subjected to very severe cutting or "wire drawing" action. The use of a bypass will help to preserve the seats. A plug disc globe type valve performs most satisfactorily in the bypass. If the main valve is equipped with an internal bypass, an external bypass is not required.

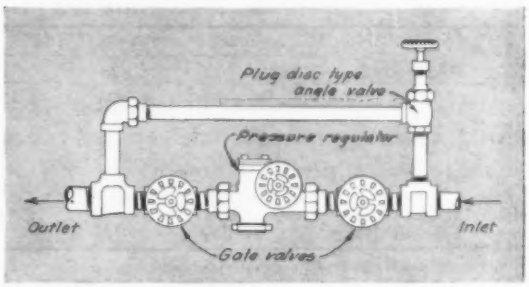
The service life of large gate or globe valves will be very short if a bypass is not used for balancing and warming up. As stated previously, a gate valve is not designed for throttling and the seats will soon be damaged. Although a globe type valve is intended for throttling, the seating surfaces of a large globe valve are very close together when warming up or balancing because of the small volume required for this purpose. The closer the seating surfaces are to each other, the quicker they will wear out from "wire drawing" action.

A small globe valve in a bypass around a main valve could be wide open to deliver the small volume of fluid needed. The main valve would be used only for full volume flow. Neither valve would then be subjected to severe cutting action.

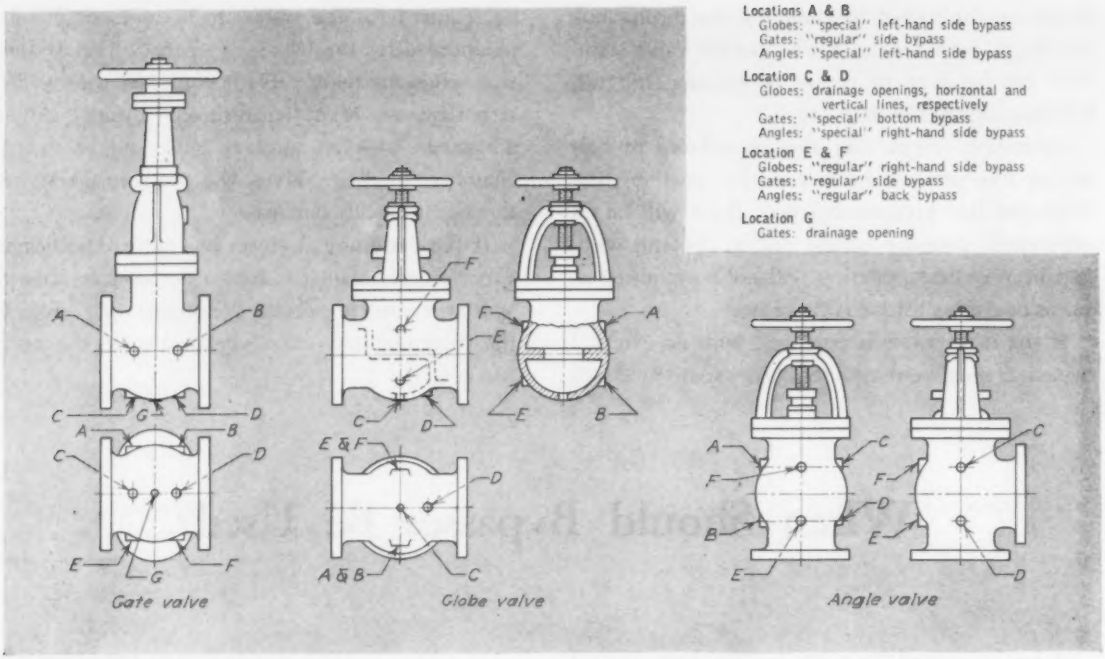
When the specifications do not cover the type of bypass valve, the manufacturer will generally supply a bypass valve which is suitable for the intended service of the main valve. For iron body gate valves — since the majority of these valves are used for water, oil, or gas — a gate bypass valve will likely be supplied. If the main valve is for steam service, a plug disc globe bypass valve will normally be used. When a steel main valve is specified with a bypass, a plug disc globe valve will probably be used.

Sometimes a throttle valve is used for service which requires alternately large and small volumes of fluid. By using a bypass around the main throttle valve, the damage to the main valve can be eliminated.

Another function of a bypass is to make it possible to remove and service equipment without shutting down the line. A typical example is a bypass around a pressure regulator, as illustrated in Fig. 27.



27 BYPASSES are used to permit removal and repair of equipment without interrupting service as shown here with bypass around a pressure regulator. They are also used for balancing line pressure and gradual warming of steam lines



28 METHOD OF DESIGNATING locations of openings for bypasses and drains is given here. Standard openings, both "regular" and "special" are listed. These designations should be used when specifying valves with bypasses or drains

What Are Standard Bypass Locations and Sizes?

The Manufacturers Standardization Society of the Valve and Fittings Industry has developed and issued a standard known as MSS SP-45 as a guide for locating and sizing bypasses and drains. The following information is quoted from this standard:

"When valves are ordered with bypass attached, the size of the bypass shall be as shown in Table 4, except where peculiar service conditions warrant consideration of a special oversize bypass, then the installation of the bypass around the main valve is recommended wherever possible.

"When gate valves are ordered with bypass attached, it shall be regular practice to attach the bypass at the side of the main valve with the stems of both valves pointing upward.

"The more common of the 'Special' attached locations is on the center of the flow line, at the bottom of the main valve, (see locations C & D, Fig. 28) with the stem of the bypass valve at right angles to the main valve stem.

"This is designated as the 'bottom attachment,' or defined as 'bypass at the bottom.' When any other 'Special' attached location or other position of the bypass valve stem is desired, a sketch should be sent to the manufacturer.

"When globe valves are ordered with bypass attached, it shall be regular practice to attach bypass at the right-hand side of the main valve, (see locations E & F, Fig. 28) with the stems of both valves parallel, pointing vertically upward. When bypass may be 'specially' required attached at the

TABLE 4 — ATTACHED BYPASS SIZES regularly furnished on valves are given here

Main valve size, in.	Bypass size, in.	
	Series A[1]	Series B[2]
4	½	1
5	¼	1-¼
6	¼	1-¼
8	¾	1-½
10	1	1-½
12	1	2
14	1	2
16	1	3
18	1	3
20	1	3
24	1	4

[1]Series A comprehends steam service for warming up before the main line is opened, and for balancing pressures where the lines are of limited volume. They are in common use on ferrous globe and angle valves and on steel gate valves.
[2]Series B comprehends lines conveying gases or liquids, where bypassing may facilitate the operation of the main valve through balancing the pressure on both sides of the disc or discs thereof. These in the larger sizes may be of the bolted on type.

left-hand side, (see locations A & B, Fig. 28) the designation shall be 'left-hand attachment.' Right-hand side of a globe valve is the side at the right, when facing the flow port which leads to the underside of the disc.

"When angle valves are ordered with bypass attached, it shall be regular practice to attach the bypass at the back of the main valve, (see locations E & F, Fig. 28) with the stems of both parallel, pointing vertically upward. When a bypass may be 'specially' required attached at the right-hand or left-hand side, (see locations C & D and A & B, respectively, Fig. 28) the designation shall be 'right-hand attachment' or 'left-hand attachment.' Right-hand side of an angle valve is at the right, when facing the back of the valve."

What Are Standard Drain Sizes?

The following information on drains is quoted from MSS SP-45:

"When valves require draining openings, they are regularly furnished with the size shown in Table 5, unless otherwise specified by purchaser.

"The application of standard symbols which have been ascribed for the locations of openings for drain and bypass connections recognized as standard is illustrated in Fig. 28. These symbols should be regularly employed on drawings, specifications, requisitions, and other instruments used in the transactions of business.

"When tapping may be required at some other location, it is recommended that the manufacturer be consulted as to its practicability, and both the inquiry and the order should be accompanied with a sketch clearly indicating the location upon the valve body."

The need for drains on valves used in power and process piping systems is discussed in more detail in ASA B31.1, the Code for Pressure Piping.

TABLE 5 — DRAIN TAPPING SIZES regularly furnished on valves requiring openings for drainage are given here

Valve size, in.	Size of drain tapping, in.
2 to 4	½
5 to 8	¾
10 to 24	1

What Standards, Ratings, and Markings Apply?

The American Society of Mechanical Engineers, the Manufacturers Standardization Society (MSS), and other groups cooperating through the American Standards Association have gone far in developing standards for the valve and fitting industry. The adoption of these standards by manufacturers is of substantial value to all valve users. As a result of this work the user is able to match flanges and other end connections of different makes. In some cases even the face to face dimensions of valves have been standardized.

The standards when followed assure safe design and materials of valves for most service conditions, as well as interchangeability. Definite pressure classes have been set, and because of this the number of necessary lines of valves required for the many different pressure and temperature conditions have been substantially reduced.

Since pressure ratings vary with the temperature of the fluid to be used, many valves are given a *primary rating*. This rating represents the basic steam pressure as covered by the American Standards. All ratings are based on *nonshock pressure*.

A standard of particular interest to the user is MSS SP-25 on marking of valves and fittings. This enables the user to identify most valves, regardless of their makes. In the proper selection of valves it is necessary to know the meanings of the various markings which generally appear on the valve body. If a marking consists of numerals only, such as "300", it represents the primary steam pressure rating. If numerals are followed by letters they represent the working pressure and the fluid for which the valve is intended. These suffix letters signify the following: A, air; G, gas; L, liquid; O, oil; S, steam; W, water; and DWV, drainage, waste, and vent.

A few examples of designations conforming to MSS SP-25 are:

Manufacturer's name or trade mark	XXX
Pressure class	250S
Other pressure designation (water, oil, or gas)	500 WOG

Manufacturer's name or trade mark	XXX
Material designation	STEEL
Pressure class — primary rating	600

Manufacturer's name or trade mark	XXX
Maximum working pressure	800*
Service recommendation	WOG

*In this case there is no primary rating.

Do Not Specify Special Materials Unless Needed

Some engineers specify in detail the materials that should be used for certain regular parts of valves. This is necessary for some special service conditions, but it should be avoided if a regular stock valve can be used. Frequently, a regular valve will give better service than a special one.

An example based upon actual experience may illustrate this point. Some high pressure, high temperature steel gate valves were specified for a particular piping installation, and it was stated that the yoke sleeves should be made of 13 percent chrome steel. The engineer was advised that under the temperature and pressure conditions outlined, this metal, when used with a stem of the same composition, would cause galling and knitting of the stem threads. The engineer changed the specifications to eliminate the special material, and actual operation proved that the available valves provided excellent service under the given conditions.

[*The author and editors wish to acknowledge the assistance provided in assembling the information for this report from the engineering department of Crane Co., the American Society of Mechanical Engineers, the American Standards Association, and many others. Tables 1, 2, and 3 are based upon information published in* Valve World. *This discussion of valve selection for piping applications will be continued in future issues. The following correction in Table 1 of the report on valves published in the January HPAC Engineering Data File should be noted. In Col "M" reference should be made to Table 3 rather than to Table 2.*]

KEEPING PACE

WITH HEATING, PIPING, AND AIR CONDITIONING

The men pictured here are editors of *Heating, Piping & Air Conditioning* magazine. They're also trained engineers and journalists who speak your language, know your interests. They're skilled from training, practice, and field experience in interpreting those interests—in words, diagrams and pictures.

You see them here at work on a tough, continuing job. Their assignment: to take the most authoritative, widely read magazine in the field of industrial, commercial, and institutional heating, piping, and air conditioning and make it still more useful, more informative for more than 18,000 paid subscribers.

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editors at work . . . . they're

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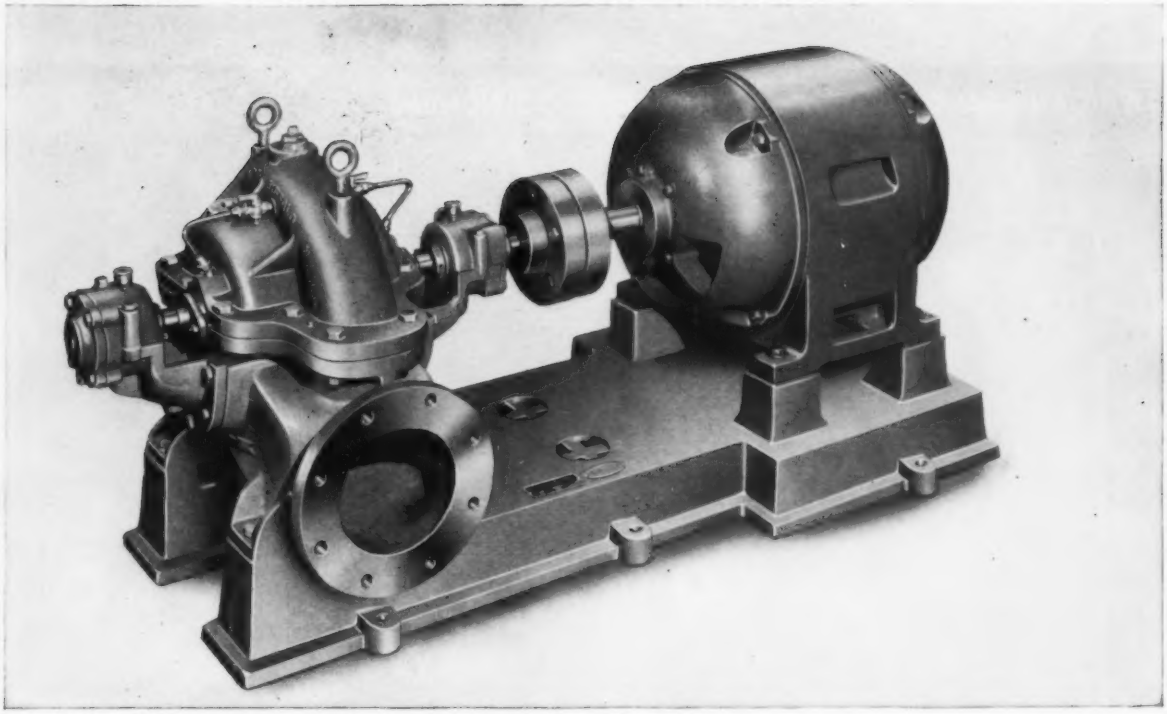

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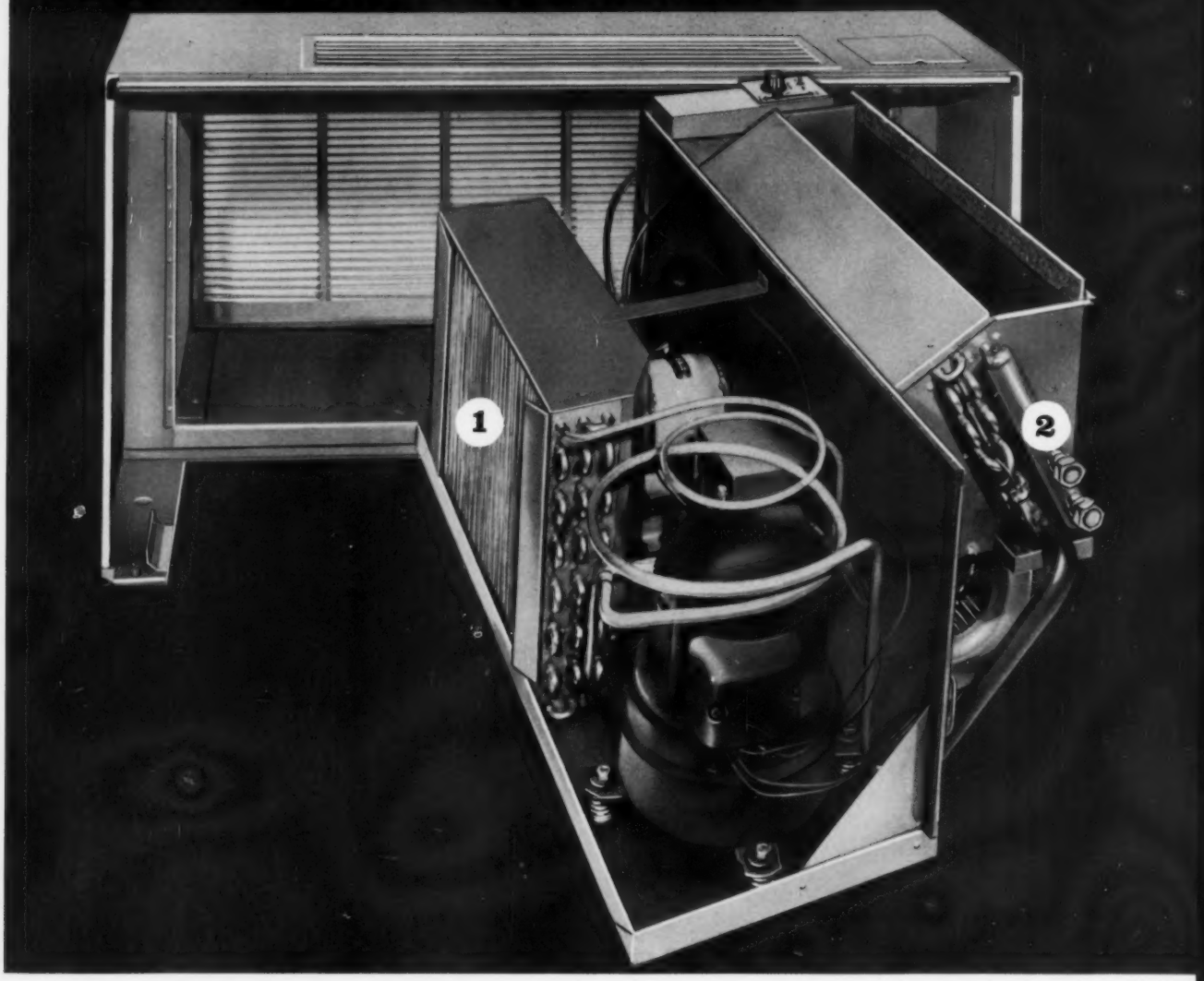

Cooling circuit (see 1) in each room unit eliminates central cooling plant and ducts. Three types of integral heating coils (see 2) are available — steam, hot water or electric. Compressor-condenser section is sealed off from the room for exceptionally quiet operation. Entire unit carries UL Re-examination Service Marker. Type 40 Remotaire is available in three models, two practical sizes.

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Heating-cooling chassis slides into wall sleeve as a single unit; slides out for easy maintenance.

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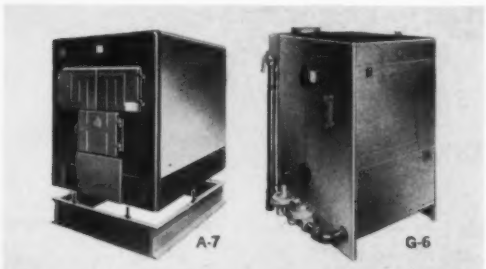

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Send for your copy of this latest P-K Data File No. 16 on Copper-Lined Storage Water Heaters

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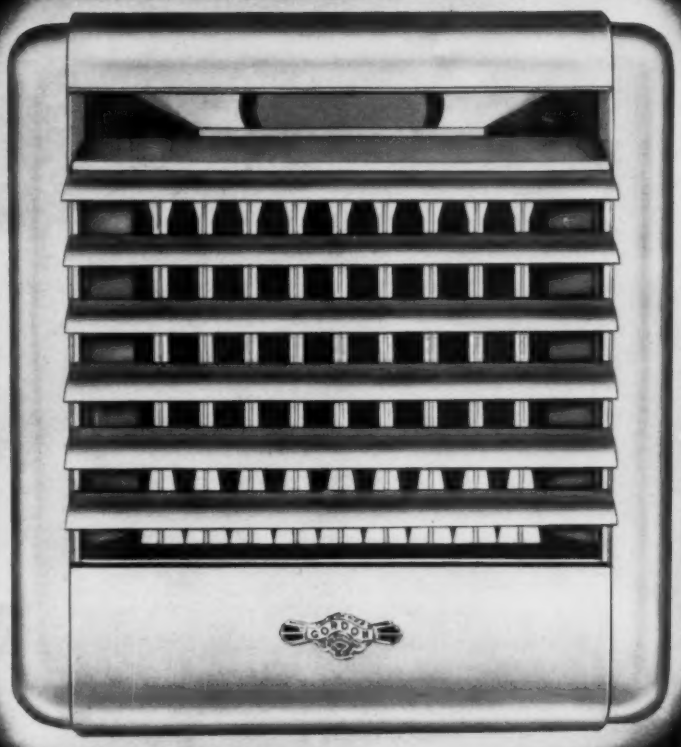

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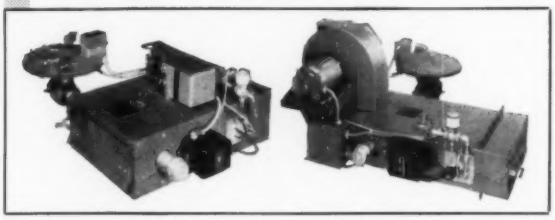

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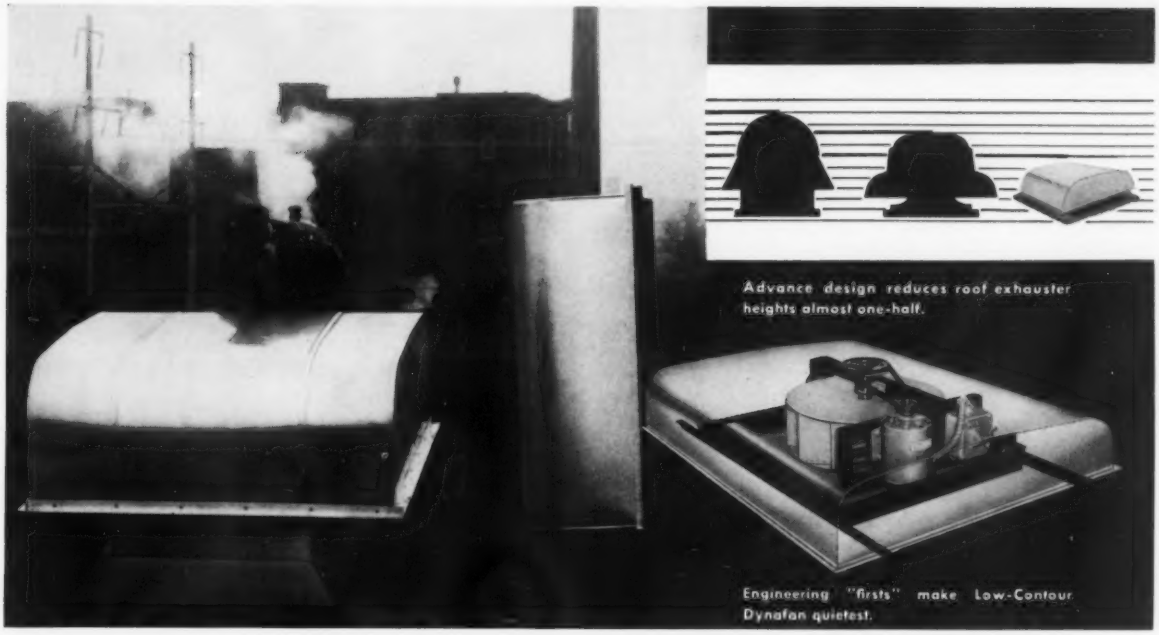

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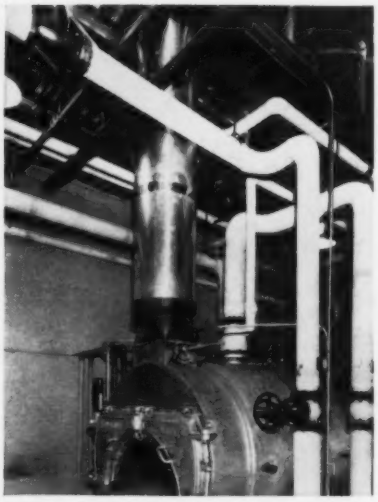
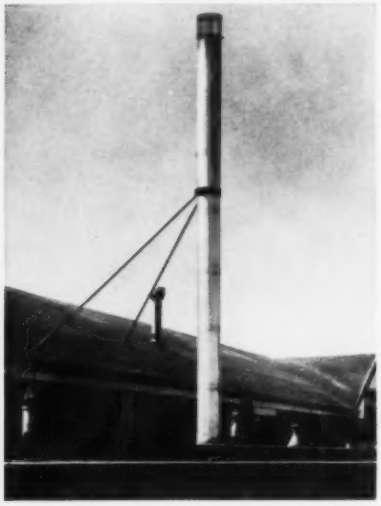


Van-Packer Stack can be superimposed on boiler or floor supported on Tee Section.



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*American Standard ASA B16.22—1951

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36T-204: Designed for flexible built-in applications, this style comes with the same variety of air damper options as cabinet style units. Can be supplied complete with standard control package options. Another model, 36T-304, is engineered for recirculating air operation only.

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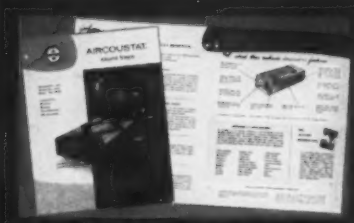
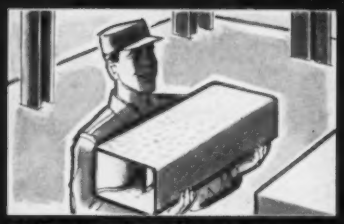
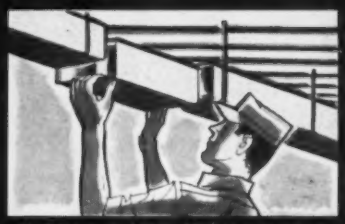


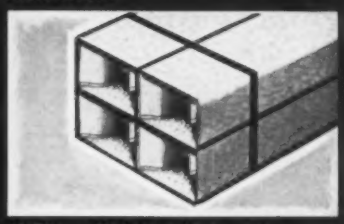
1) Easy to select—Just 3 steps to specify proper model. Save time, avoid errors.



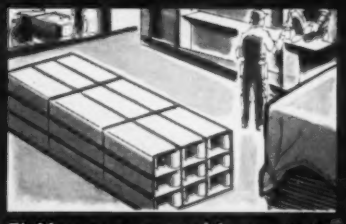
2) Easy to handle—No riggers or special equipment needed. Large units composed at job site.



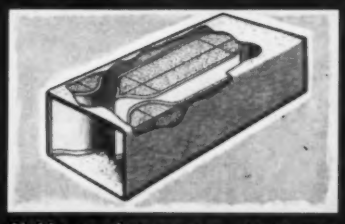
3) Easy to install—Units are installed the same as ductwork. Units have 2" extensions.



4) Fits all duct sizes—Big units are easily assembled from small Aircoustat units.



5) No storage problem—Units are delivered right to the job site, ready to install.



6) No maintenance—Units are fire-resistant, dust-proof and built to last a lifetime.

7) Guaranteed results—Solves every noise reduction problem. Units are completely reliable.

Pre-engineered by Koppers to eliminate guesswork, unnecessary calculations and difficult installations, AIRCOUSTAT Sound Traps guarantee trouble-free silencing of all duct-transmitted noise . . . at a savings in time and money to you.

AIRCOUSTAT selection is quick, simple and reliable. A choice of over 60 stock models, fabricated in 6 lengths, solves every noise reduction problem. AIRCOUSTAT is built to give a lifetime of maintenance-free service.

Write today for your copy of the AIRCOUSTAT Selection Manual, a quick guide to the right unit or combination of AIRCOUSTAT units to eliminate duct-transmitted noise in all air handling systems. Write KOPPERS COMPANY, INC., Sound Control Department, 3404 Scott Street, Baltimore 3, Maryland.

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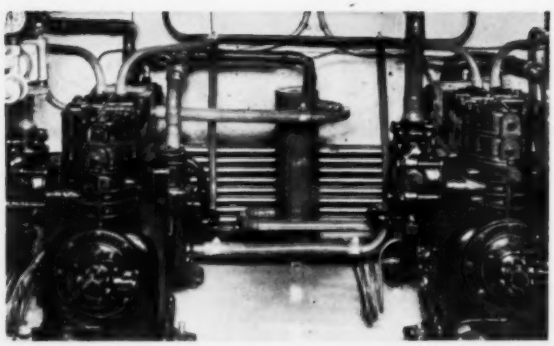
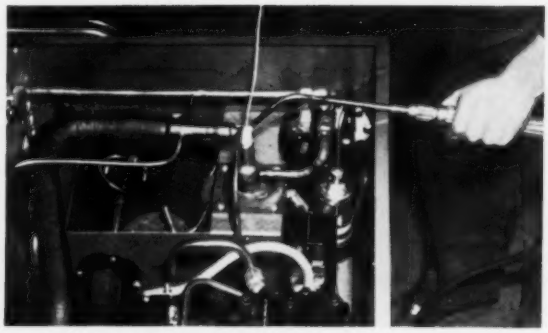


Here is a cascade refrigeration system using Freon 22 and Ethane refrigerant. This system cools five gallons of oil per minute to minus 70° F. All of the refrigerator tubing on both high- and low-pressure sides is brazed with SIL-FOS (approximately 185 joints). Some joints fluctuate in temperature from minus 200° F to plus 70 or 80° F.

Here, operator brazes the tube bundle before assembling it in condenser shell. Hand gas-air torch keeps the SIL-FOS flowing freely.

Now the tube bundle is being brazed to the sheet by the same simple heating method.



Operator puts finishing touches on last joints of small two-stage unit.

20 Years Without A Joint Failure . . . Harris Refrigeration Sets This Record With SIL-FOS

This 20 year failure-free record is even more remarkable since the joints of Harris equipment are subjected to extreme temperature, pressure and thermal shock far in excess of an ordinary refrigerator.

A pioneer in the design and manufacture of low-temperature refrigeration equipment for science and industry, Harris Refrigeration Company, Cambridge, Massachusetts, finds Handy & Harman SIL-FOS the brazing alloy that meets all its stringent requirements for high strength, leak-tightness and durability. Specified for 20 years in the production of Harris units ranging from small refrigerators for cold-treating ball bearings to a giant big enough to chill a 20-foot, 10-ton mill roll, SIL-FOS has always assured highest quality joints while providing the production flexibility and economy essential to efficient manufacturing.

Time, strength and leak-tightness are, by themselves, excellent reasons for specifying SIL-FOS. There are many more. Like brazing's inherent economy. Like the ease and speed with which joints are made. And like the quality SIL-FOS joints assure your product. We would like to give you all the necessary brazing background you may require . . . call us.

GET THE FACTS FROM BULLETIN 20

This booklet gives a good picture of silver brazing and its benefits . . . includes details on alloys, heating methods, joint design and production techniques. Write for your copy.

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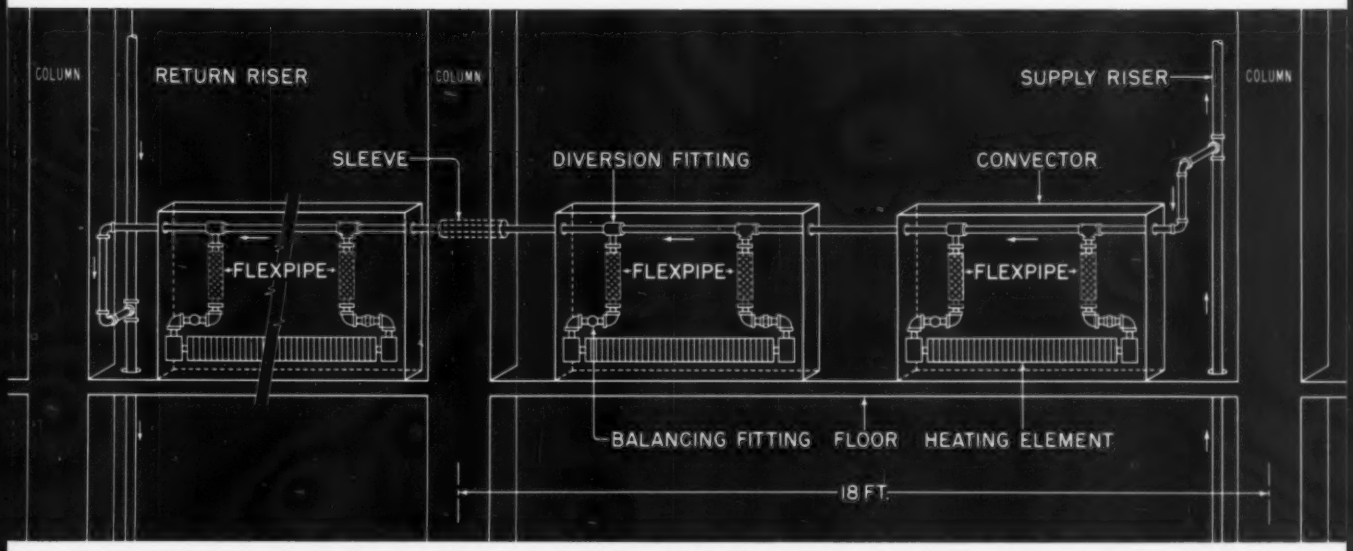
APPLICATION HINTS:

Ways to simplify construction and cut costs with Flexpipe

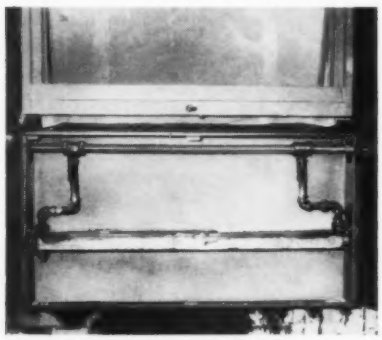


Heating system in Intensive Treatment Building, Norwich State Hospital. Architect: Lester Julianelle, New Haven, Conn. Consulting Mechanical Engineer: Hubbard, Lawless & Blakeley, New Haven, Conn. Plumbing & Heating Contractor: George Kaucher Co., Wolcott, Conn.

Flexpipe connectors at convectors provide big savings in pipe and fittings for hospital heating system

THE PROBLEM: To reduce the cost of installing the heating system in the 300-bed Intensive Treatment Building of the Norwich, Conn., State Hospital. The hospital was constructed under an appropriation of $5,000,000.

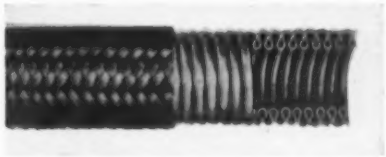
THE SOLUTION: Consulting mechanical engineers, Hubbard, Lawless & Blakeley of New Haven, devised a system using single horizontal mains passing through a number of convector cabinets in series. The runs go up to 70 feet, connecting as many as eight convectors. Each bay of approximately 18 feet has two convectors and the columns are sleeved to accommodate the mains. This arrangement, of course, greatly reduced the number of risers and fittings.



One of the convectors in the Norwich State Hospital, showing how Flexpipe connectors are used to join the main and the heating element.

In the long runs, however, expansion is a big problem. So rigid connections at the convectors were out of question. Flexpipe connectors were used at the convectors as shown in the drawing above. The mains can expand and contract, with no strain on the heating elements. The savings planned were accomplished because both the quantity of pipe and the number of fittings are at an irreducible minimum.

WHERE TO BUY: Flexpipe connectors come in convenient standard sizes from ¼ inch through 2 inch, and are sold by leading distributors throughout the country. For the name and address of the one serving your area, or for more detailed information, write to: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 59154



Flexpipe has core of flexible seamless tin bronze tubing. No packing. 100% tight. Tin bronze wire braid covering for extra strength. Brass fittings attached. Packaged in clear, tough polyethylene bag for easy identification, handling and warehousing. Flexpipe connectors also available in larger sizes for pump and compressor connections. Write for Bulletin FP-4.

Flexpipe®

an

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Top economic life!...

Transite Pipe is strong, lightweight, easily handled . . . only larger diameters need handling equipment.

The Ring-Tite Coupling speeds and simplifies installation . . . assures lasting protection against leakage.

Transite Pipe is priced, designed and formulated to be today's best buy in factory water mains

When it comes to pressure pipe—you can pay more than you would for Transite®. Or you can pay less. But no other material gives you more than Transite in *economic life!* For Transite's every advantage—whether of price, installation or performance—contributes to maximum, long-term economy.

First, there's Transite's low cost. Then, there's its installation economy! Lightweight, easily handled, it needs fewer men to install it. Installation is made still faster, *surer* with Transite's Ring-Tite® Coupling that provides a tight, lasting seal.

Once in operation, savings continue. Transite's smooth interior stays smooth—keeps pumping costs low, assures full water flow for the life of the pipeline. Made of asbestos-cement, Transite keeps maintenance to the barest minimum . . . it can't rust, is highly resistant to both corrosion and electrolytic action. Write for Pressure Pipe folder TR-160. Ask too about Transite Pipe for other plant services. Write Johns-Manville, Box 14-FA, New York 16, N.Y.

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HOW ABOUT YOU?

Do you know that many cancers can be cured if detected early? That an annual health checkup is your best protection against cancer?

Are you giving yourself this big advantage? Or are you taking chances with your life because of foolish attitudes about cancer like these?

DON'T EVEN MENTION THAT WORD!

Fear keeps some people from even *learning* cancer facts that can save their lives.

NEVER FELT BETTER!

Checkups help to detect cancer in its "silent" stage before you notice any symptom.

COSTS TOO MUCH!

Dollars you spend for the protection of your health can mean years of life.

Millions of Americans have made an annual checkup a habit...*for life.* How about you?

AMERICAN CANCER SOCIETY

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Here's the end suction pump line that combines performance, efficiency, versatility, convenience and *immediate availability* all in one package – the Peerless REDI-PAK. Comprised of 22 of the most popular size Fluidyne pumps, in sizes from 1 to 15 hp, the individually packaged, factory-fresh pumps are available *right now!* They're versatile, able to handle nearly every general purpose pumping job. They're well designed and soundly constructed. They're a compact pumping unit that fits easily into most all piping layouts. They're easy to maintain, operate indoors or outdoors, on continuous or intermittent duty.

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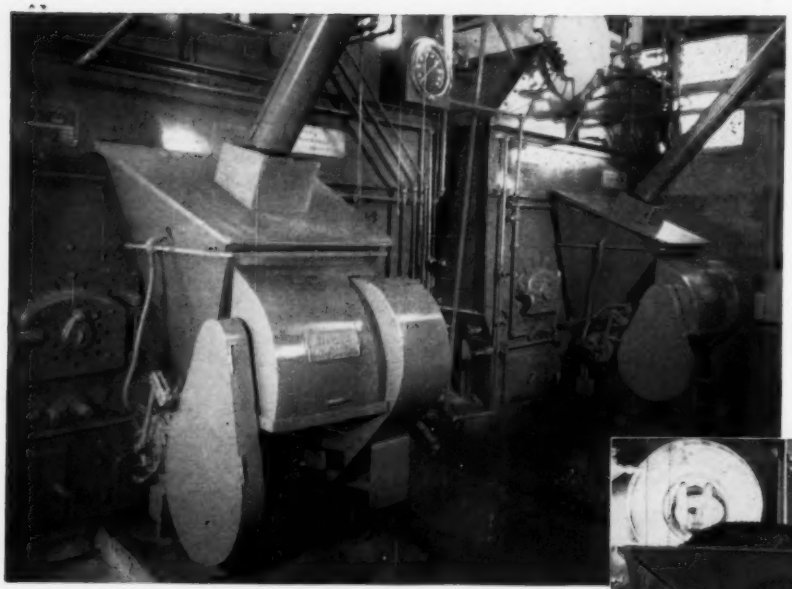
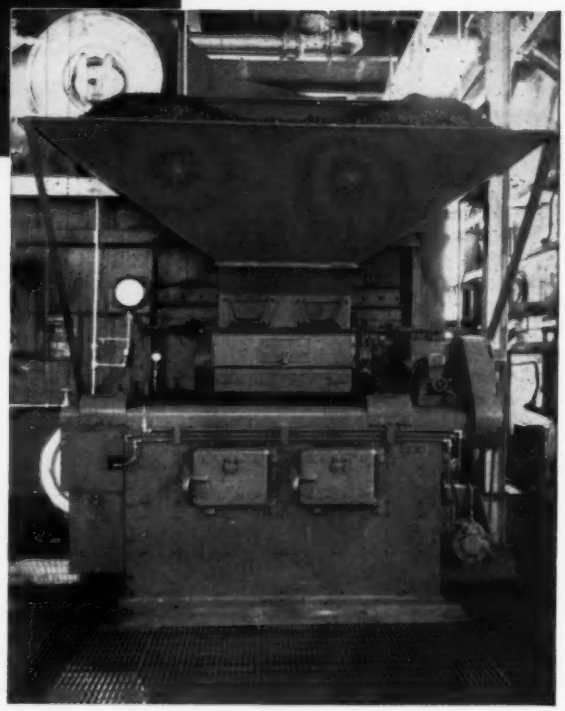
Does Your Package* Include

DETROIT STOKER ECONOMY?

*Package Boilers, of Course



Detroit LoStokers firing two Wickes Package Boilers, Type A.O. continuous rating—6000 pounds steam per hour.



Detroit RotoStoker "CC"—continuous cleaning, Firing Springfield high pressure Package Boiler. Continuous rating—35000 pounds steam per hour. One of five furnished one customer.

As the installation convenience of the package boiler is more and more widely appreciated, the question often is asked "Why can't we have the advantages of a package boiler with the economy of efficient coal firing?"

The answer is—you can. Water tube package boilers designed for stoker firing are readily available.

And a *Detroit* Stoker gets the most economy out of coal, the most economical fuel. This economy plus the exceptional dependability and low maintenance of Detroit Stokers assures you steam at the lowest cost.

The Detroit Stoker line includes a number of types specially adapted to package boilers.

DETROIT STOKERS COST LESS . . . COST EQUALS INITIAL INVESTMENT PLUS UPKEEP PLUS PRODUCTION LOSSES DUE TO EQUIPMENT OUTAGE. THE TOTAL IS LESS WITH DETROIT.

Ask for details on Detroit Stokers with package or other boilers.

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ANACONDA® **COPPER TUBE AND FITTINGS for soil, waste and vent lines**
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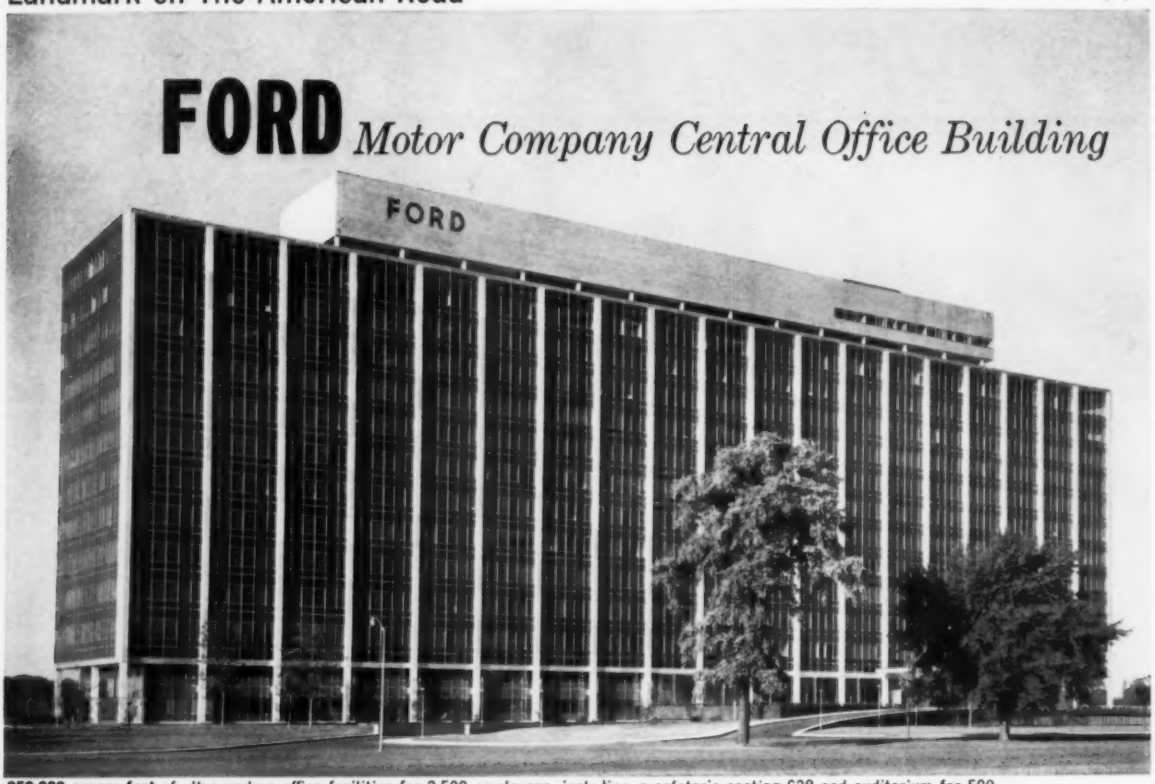
Landmark on The American Road

FORD *Motor Company Central Office Building*



950,000 square feet of ultra-modern office facilities for 3,500 employees, including a cafeteria seating 638 and auditorium for 500.

Architects: SKIDMORE, OWINGS & MERRILL, NEW YORK
General Contractor: BRYANT & DETWILER

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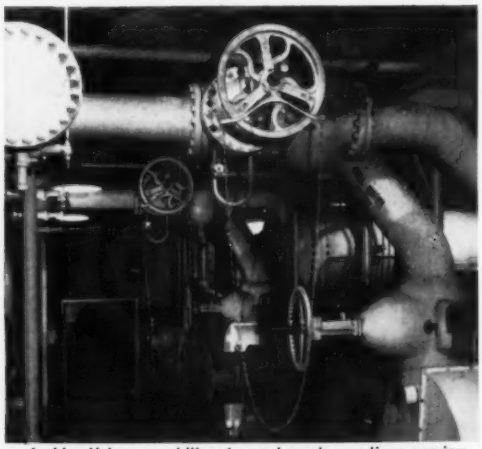
because efficiency is a part of the over-all design

Beauty, comfort, efficiency — Keynote in the planning of Ford cars, this combination also was sought and clearly achieved in the Central Office Building of Ford Motor Company, Dearborn, Michigan.

With efficiency a part of the over-all design it is not surprising to see Jenkins Valves on the plumbing, heating and air conditioning pipelines in this superb building. For almost a century the name JENKINS has meant reliability . . . valves with the enduring quality to last the life of a building. It will pay you to have this important assurance when you specify or install valves, especially since Jenkins Valves cost no more. Jenkins Bros., 100 Park Ave., N.Y.17.



Jenkins Valves on chill water and condenser lines serving Ford building's 2,200-ton air-conditioning system.

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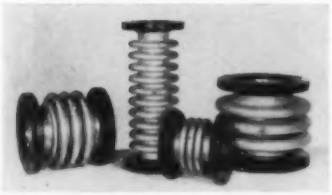
EQUIPMENT DEVELOPMENTS . . .

For reviews of Recent Trade Literature see page 227



Bellows Expansion Joints

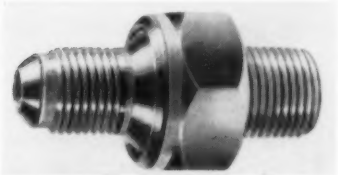
. . .with test-rated cycle life—*Tube Turns, Div. of Chemetron Corp., Dept. HPAC, 224 E. Broadway, Louisville 1, Ky.*

Initial production of stainless steel bellows expansion joints will be in 3 to 30 in. normal pipe sizes for applications up to 275 psi and 750 F. Suggested applications for bellows expansion joints include: use in restricted space where installation of expansion loops would be uneconomical or impossible; limited available-pressure drop applications; use with large pipe sizes.

Air Cooled Condensers . . .

. . .in nine models with nominal capacities from 15 to 100 tons—*Marley Co., Dept. HPAC, 222 W. Gregory Blvd., Kansas City 14, Mo.*

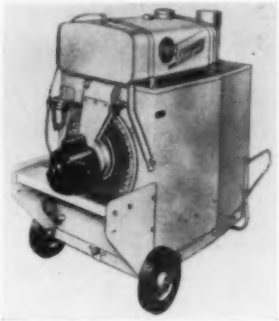
"DriCoolers" are horizontal units with vertical, blow-through air flow from single industrial type fan. All units have angularly mounted modular condenser coil sections forming plenum chamber to equalize air pressures over all areas of coil sections. Plate type fin coils with aluminum fins, small diameter copper tubes require minimum refrigerant.



Safety Head . . .

. . .designed to permit normal working pressure of refrigerant system up to 75 percent of predetermined set point of rupture disc—*Black, Sivalls & Bryson, Inc., Dept. HPAC, 7500 E. 12th St., Kansas City 12.*

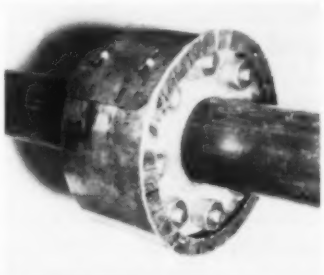
Sealed-type safety head said to eliminate "fatigue factor" to permit uninterrupted service during peak cooling periods.



Portable Air Heater . . .

. . .re-engineered for intermediate capacity—*American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8, Ky.*

"Economy" model reinstated in company's line to provide moderate priced portable heater. Supplies heat in capacities up to 270,000 Btu per hr. Operates on gasoline or fuel oil, with no adjustments necessary.



Flange Shield . . .

. . .developed to protect workers from surprise high pressure leaks due to gasket failure—*Ramco Mfg. Co., Dept. HPAC, 540 Westfield Ave., W., Roselle Park, N. J.*

Shield held ½ in. away from edge of flange by spacers. Overlapped, totally enclosed edge breaks force of stream, deflects it at safe angle. Constructed of heavy gage hot dipped galvanized sheet metal. Slips over existing pipe installations. Available for 150 to 2500 psi pressure slip-on, welded neck, and lap joint flanges in pipe sizes 1 to 12 in.

Nozzle Coking Insulation

. . .for gun-type burners—*Socony Mobil Oil Co., Inc., Dept. HPAC, 150 E. 42nd St., New York 17.*

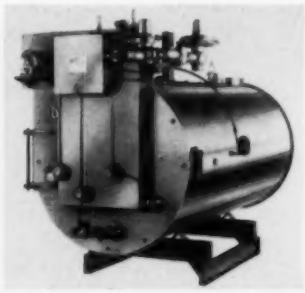
Process developed by fuel manufacturer calls for application of paste of insulation cement and water to front end nose piece and space between combustion chamber wall and burner blast tube. Insulation on nose piece should be about ½ in. thick and space between chamber and burner should be filled. Oil drain hole at bottom of nose piece should not be covered. All insulation that may have become lodged in air passages should be removed. Booklet, "Remedy For Nozzle Coking of Gun Burners," outlines entire process.

Immersion Water Heater .

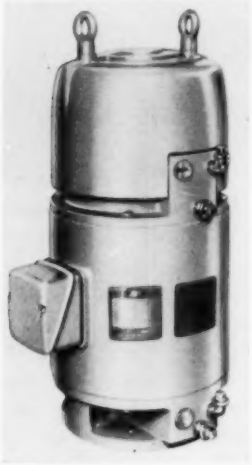
. . .with modified front construction designed to permit revised arrangement of oil burner equipment, controls, accessories—*Sellers Engineering Co., Dept. HPAC, 4876 N. Clark St., Chicago 40.*

Optional construction arrangement of "Model BT" said to result in less

EQUIPMENT DEVELOPMENTS
Continued



width of floor space requirements. Controls, accessories grouped above floor line. Shell may be located in position and water lines connected before uncrating, bolting on front section.



Vertical Motors . . .

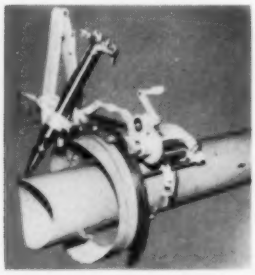
. . . available in ratings of 1 to 30 hp —*Louis Allis Co., Dept. HPAC, 427 E. Stewart St., Milwaukee* 1.

"Climatized" vertical hollow shaft motors designed to provide indoor and unprotected outdoor service on shallow or deep-well turbine pump applications for petroleum product handling, chemical pumping, power plant condenser cooling, other industrial installations.

Pressure Control . . .

. . . in two new models—*United Electric Controls Co., Dept. HPAC, 79 School St., Watertown 72, Mass.*

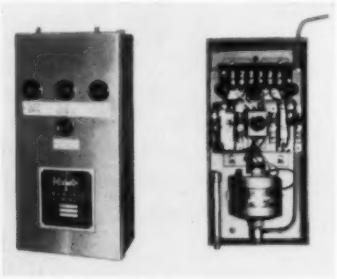
"Model 670" and "Model 680" added to "Type J11" pressure control series. "Model 670" ranges from 50 to 1000 psi; "Model 680" ranges from 100 to 1700 psi. Both have maximum bellows pressure of 3500 psi. Bellows constructed of stainless steel with brass pressure connections.



Pipe Cutting Machines . . .

. . . in improved designs — *H & M Pipe Cutting and Beveling Machine Co., Dept. HPAC, 311 E. Third, Tulsa, Okla.*

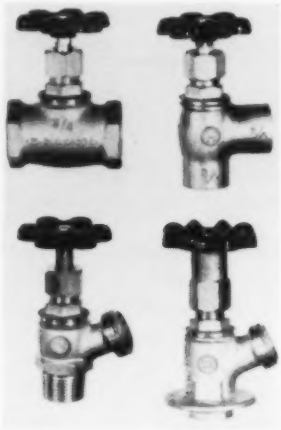
"Shape Cutter" attachment (shown above) completely remodeled for fast mounting. Designed to cut various shapes of pipe intersections automatically. "Out-of-Round" attachment has addition of free-wheeling roller assembly that turns 360 deg. Roller rides surface of pipe, automatically makes corrections for imperfections.



Liquid Level Controls . . .

. . . available for pressure ranges from 0.02 to 100 psi and to 30 in. Hg vacuum—*Petrometer Corp., Dept. HPAC, 43-22 10th St., Long Island City, N. Y.*

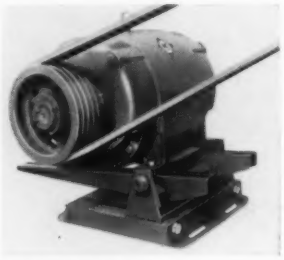
"Series 1800" liquid level controls actuated by pressure element connected through tubing transmission lines to pickup device located in tank at approximate level where alarm or activation desired. Pressure actuates combination of electrical components to perform variety of electrical functions. Construction features include: high capacity midget relays with silver contacts; snap action switch; beryllium copper diaphragm pressure element, also available in stainless steel.



Valves . . .

. . . in 12 new patterns—*Hammond Valve Corp., Dept. HPAC, 1844 Summer Blvd., Hammond, Ind.*

"Full-Flo" valve line consists of stop, stop and waste, angle stops, boiler drains, sill cocks for iron pipe and copper tubing. Valves said to have full flow throughout with full port openings, quick opening and closing feature, and back seating under pressure to allow repacking when fully open. Available in ½ and ¾ in. sizes.

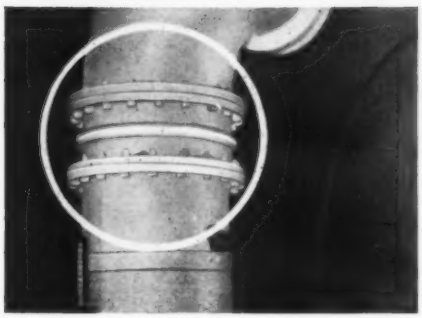


Motor Bases . . .

. . . developed to provide simple method of maintaining belt tension under varying load conditions—*Allis-Chalmers Mfg. Co., Dept. HPAC, 1171 S. 70th St., Milwaukee* 1.

"Tiltex" reaction torque, pivoted motor base made of welded, pressed steel construction. Offered for use with all motors built in NEMA frame sizes through No. 505. Larger bases also supplied.

How long can a U. S. Rubber Expansion Joint last



...some have been on the job since 1926, the year they were invented!

Here are just a few reasons why *these flexible connections are used in pressure or vacuum pipe lines...*

- U. S. Rubber Expansion Joints are resilient and, therefore, do not, like metal, set permanently when compressed.
- Constant flexing merely keeps "U. S." joints "alive"...prevents them from becoming brittle.
- They absorb both axial *and* lateral deflection far more than metal joints. Greater insulation against vibration and pump noises is provided.
- There is never any electrolysis, corrosion or erosion.
- U. S. Rubber joints handle pressures from 40 lbs. to 125 lbs. Compare!
- Outside diameter of arch is smaller than on metal joints. Face-to-face dimensions (even with multiple arches) are smaller.
- Weight is much less. This, plus the fact that no gasket is needed between flanges (unlike metal joints) results in an easier installation, lowering the cost.

"U. S." originated rubber expansion joints. They are at work in every kind of industry, prolonging the life of equipment in pressure or vacuum pipe systems.

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

Mechanical Goods Division

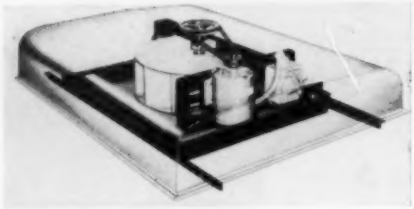
United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

EQUIPMENT DEVELOPMENTS

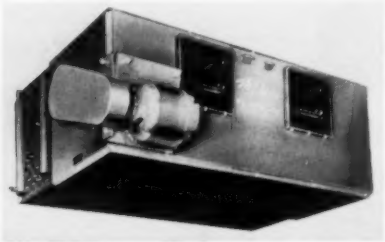
Continued



Roof Exhaust Fans . . .

. . . in streamlined silhouette design—*Penn Ventilator Co., Inc., Dept. HPAC, Goodman St. and Allegheny Ave., Philadelphia* 40.

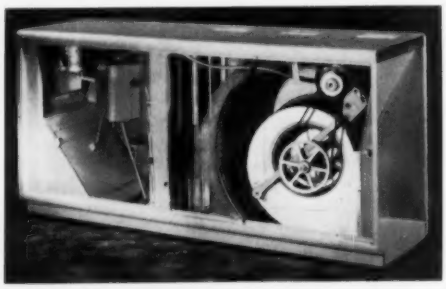
"Dynafans" are weatherproof, streamlined units. By placing motor parallel to wheel, height of unit has been reduced by almost 50 percent. Sound level reduced by straddled bearing design. Entire fan unit mounted on "Vibra-Sorb" rubber vibration eliminators. Available in 15 models in wide range of motor powers, fan speeds, air capacities. Construction in aluminum, copper, steel, stainless steel. Heights range 14 to 36 in.; lengths from 33 to 144 in.



Air Cooled Condenser . . .

. . . in low silhouette design requiring minimum space —*McQuay, Inc., Dept. HPAC,* 1600 *Broadway, N. E., Minneapolis* 13.

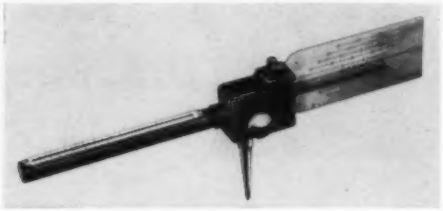
"AL Aircon" available in seven models with capacities 10 to 50 tons for indoor or outdoor applications. Design incorporates forward curved, centrifugal fans with large outlet housing for quiet operation. Up to 16 unit arrangements, six fan discharge arrangements for indoor, outdoor applications available.



Air Handling Unit . . .

. . . for school applications—*Lennox Industries, Inc., Dept. HPAC,* 1701 *E. Euclid Ave., Des Moines, Iowa.*

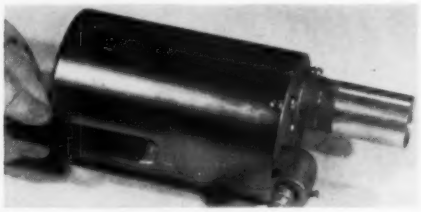
"DV32-1200" air processing unit design incorporates control panel, damper arrangement to handle substantially greater volume of air for each classroom. Also possible to use larger or smaller capacity heating sources with unit. Factory wired, assembled control panel provided. Also has damper motor assembly. Bulletin available from manufacturer describes product in detail.



Vibration Indicator . . .

. . . in light, compact, hand-size design—*Korfund Co., Dept. HPAC,* 48-01 *F* 32*nd Pl., Long Island City* 1, *N. Y.*

Vibration indicator has following applications as cited by manufacturer: measures vibration frequency, amplitude; determines direction of maximum transmitted disturbances; locates cause of unwanted noise due to resonant transmitted disturbances; measures speeds of rotating equipment where shafts or rotors are not readily accessible. Has full frequency range from 120 to 15,000 cpm.



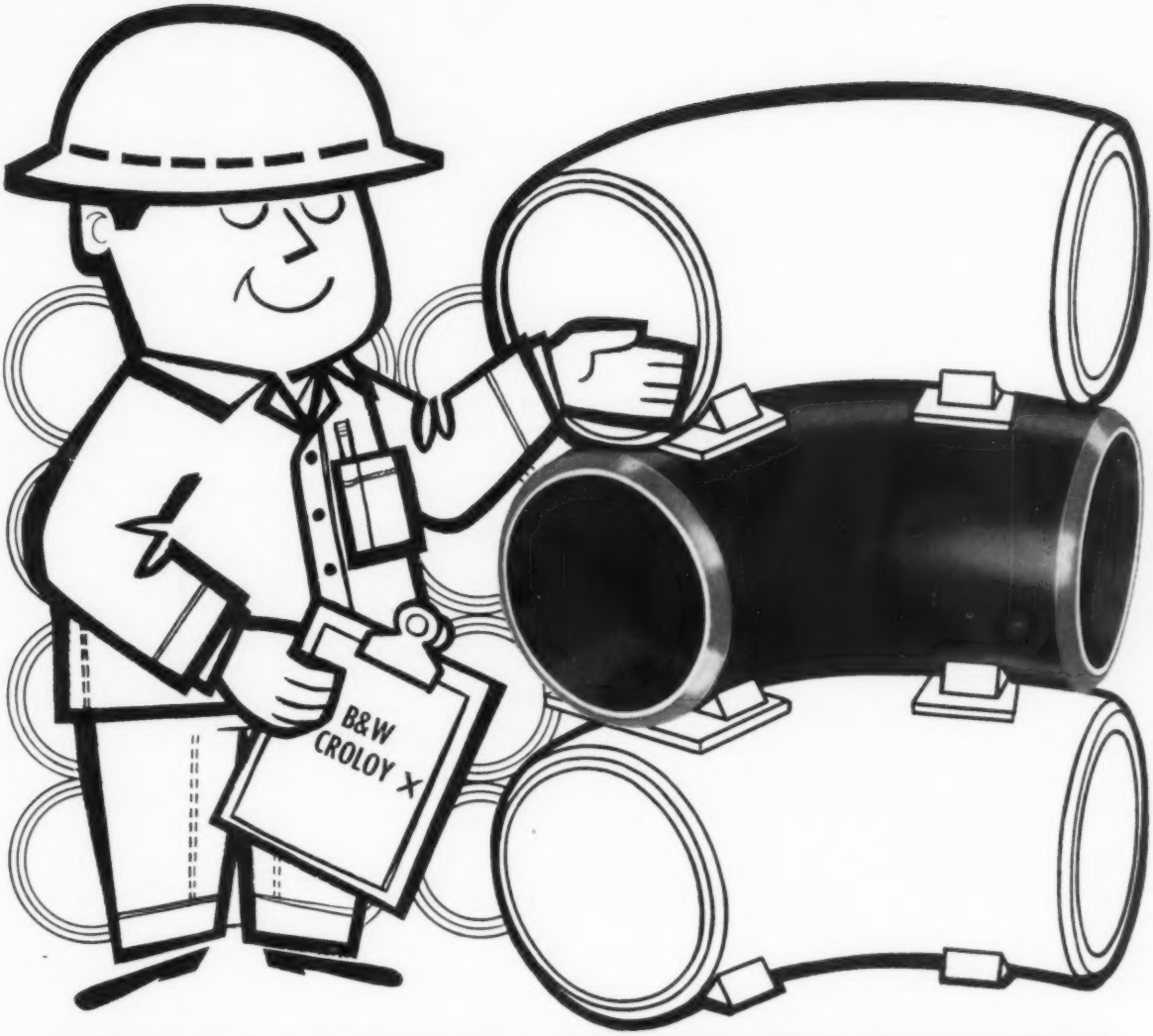
Flame Detecting Unit . . .

. . . intended for use on all types of commercial, industrial heating or processing burners—*Minneapolis-Honeywell Regulator Co., Dept. HPAC,* 2747 *Fourth Ave., S., Minneapolis* 8.

Ultraviolet-sensitive tube works with amplifier circuit in self-contained "C7012A Ultra Vision Flame Detector" system to add up impulses of electrical energy generated by tube as it counts ultraviolet rays present in all types of flame. System has ambient temperature rating of 50 to 135 F; can be used to sight temperatures to 2200 F. Models available for operation on 120, 208, 240 volts, 50/60 cycles. For use on 25 cycles, frequency doubler allows unit to be operated on 50 cycles.

Oil-Fired Boiler . . .

. . . developed for use in apartment and commercial buildings with steam or hot water installations—*American-Standard, Plumbing and Heating Div.,*



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When writing the specifications on an alloy piping job — specify B&W Job-Matched Welding Fittings. They are available in a complete range of types and sizes in carbon steel and, of course, the famous B&W CROLOYS. Call your local B&W District Sales Office or any qualified welding fittings distributor. For technical data on B&W Fittings write for the new 12-page Bulletin FB-78. The Babcock & Wilcox Company, Tubular Products Division, Fittings Department, 3839 W. Burnham Street, Milwaukee 46, Wisconsin.

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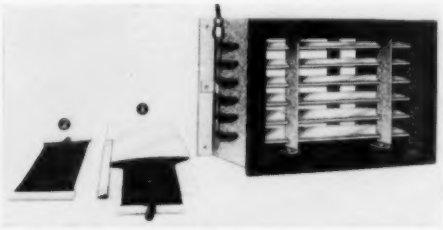
EQUIPMENT DEVELOPMENTS

Continued

Dept. HPAC, 40 W. 40th St., New York 18.

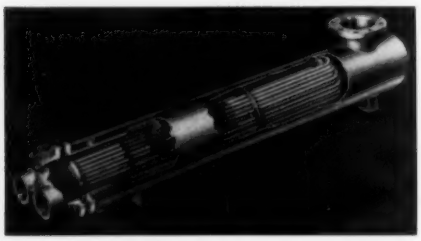
"A-5" oil-fired boiler designed for oil operation in net installed capacities ranging from 195 to 622 Mbh. Tankless heater arrangement allows insertion of separate heater in each center section to produce multi-temperature hot water. Wet base construction permits unit to be installed directly on combustible flooring. Boiler available in range of eight sizes for hot water or steam and in six sizes as boiler-burner units.



High Velocity Air Valve . . .

. . .engineered to operate without motors or linkage mechanism—*Connor Engineering Corp., Dept. HPAC, Danbury, Conn.*

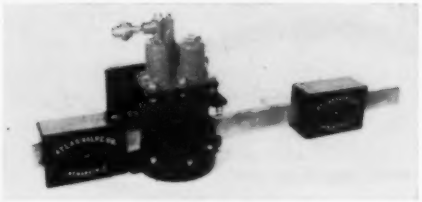
Operation of "Pneumafoil" high velocity air valve is by 15 psi pneumatic control system. Each of unit's airfoil type vanes encloses sealed neoprene actuator connected to control air. As air pressure increases, actuators inflate, expand vanes, constricting open area between vanes and throttling air flow. Complete shut-off achieved when expanding vanes make contact. For dual duct applications, two valves mounted in mixing box. Available in 16 sizes from 10 × 6 in. to 32 × 24 in. Air capacities range 1500 to 9600 cfm.



Instantaneous Heaters . . .

. . .in design with extra-large steam entrance area beyond tube bundle intended to prevent tube damage by impingement—*American-Standard, Industrial Div., Dept. HPAC, Detroit 32.*

Standard construction of "Type W-100" consists of steel shells, cast iron bonnets, seamless copper alloy U-tubes. Available in 128 sizes with two and four pass arrangements with nominal tube lengths to 10 ft and shell diameters through 20 in. Intended for wide range of water heating requirements; special units built to handle other fluids.



Pressure Regulator Pilot

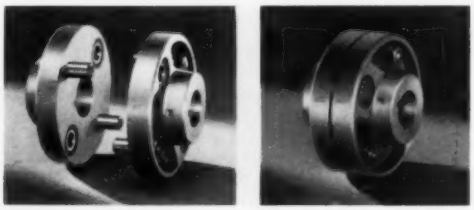
. . .designed to reduce, regulate pressure of steam, air, gases, liquids within fraction of 1 psi in one stage—*Atlas Valve Co., Dept. HPAC, 280 South St., Newark 5, N. J.*

"Fig. 8000" pressure regulator pilot, which uses air or water pressure (20 to 75 psi) to actuate control valve, can be used with single and double seat valves, ½ to 12 in. inclusive. Can be modified for reverse action.

Refrigerant Driers . . .

. . .offered in 2, 4, 6 cu in. sizes—*Ansul Chemical Co., Refrigeration Products Div., Dept. HPAC, Marinette, Wis.*

"Line-Flo" in-line refrigerant driers offered with ¼ or ⅜ in. fittings for 6 cu in. size, and ¼ in. fittings for smaller sizes. Units have monel inlet and outlet screens to take damaging solids out of circulation. Where flow rates are normal, driers can be used in applications up to a 25 lb charge for refrigerant No. 12 or a 9 lb charge for refrigerant No. 22.



Flexible Couplings . . .

. . .developed for use on direct-driven machinery where torque is not excessive in relation to shaft diameter—*Ajax Flexible Coupling Co., Inc., Dept. HPAC, Westfield, N. Y.*

Design of "Series 400" flexible couplings utilizes steel studs, rubber cushioned sleeve bearings, requiring no lubrication. Cast semi-steel flanges machined on periphery and face to simplify checking alignment. Available in four sizes: 1¼, 1¾, 2¼, 2¾ in. maximum bore, with standard square keys.

All are properties of copper, bronze and brass joints assembled with Westinghouse Brazing Alloys. Cost less, too, and they are easy to use.

Yours for asking—a new 4-page bulletin which gives properties, uses, melting ranges and other data on the family of Westinghouse Phos-Copper® and Phos-Silver® brazing alloys. Write: Welding Division: Westinghouse Electric Corporation, 4454 Genesee Street, Buffalo 5, New York.

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EQUIPMENT DEVELOPMENTS
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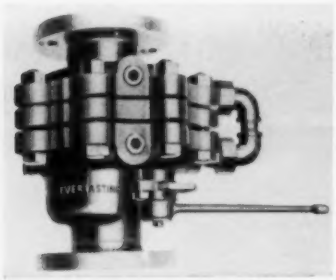
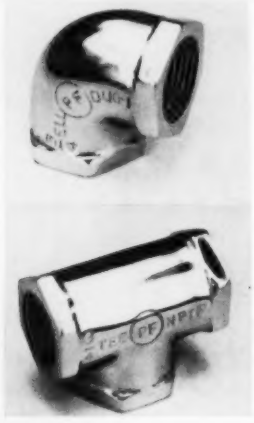


Steam-Jacketed Valve . . .

. . .of improved design—*Everlasting Valve Co., Dept. HPAC, 49 Fisk St., Jersey City 5, N. J.*

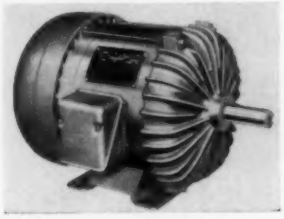
Design change said to assure constant temperature of materials such as tar, asphalt, pitch, paraffin, which will congeal or harden. Valve jacketing extended over neck. Jacket space surrounds port openings, as well as body. Available in two models: iron body valve for 125 psig line pressure with 250 psig jacket pressure, straight operating lever for pipe sizes 1½ to 4 in. and 6 in. with compound lever; cast steel body valve for 150 psig pressure with 300 psig jacket pressure and compound operating lever for 6 in. pipe.



Pipe Fittings . . .

. . .made of malleable ductile normalized air furnace iron—*Pipe Fittings, Inc., Dept. HPAC, Wellington, Ohio.*

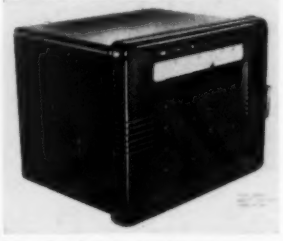
"Dryseal" threaded NPTF pipe fittings available in pipe sizes ⅛ through 2 in. in hot dip galvanized finish. Fittings include tees, 45, 90 deg elbows, reducing couplings and tees, pipe caps, hex bushings, unions, nipples. Recommended by manufacturer for pressures to 10,000 psi in pressure vessels and surge pressures in excess of 5000 psi in hydraulic systems.



Explosionproof Motors . . .

. . .of single phase type—*Robbins & Myers, Inc., Dept. HPAC, Motor Div., Dept. HPAC, 1345 Lagonda Ave., Springfield, Ohio.*

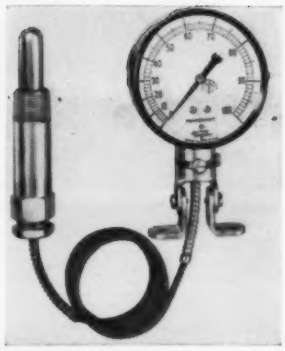
New line of single phase motors available in totally-enclosed, fan-cooled, explosionproof frames. Provided in two, four, six pole speeds, motors built in re-rated NEMA frames 182, 184, 213, 215. Ratings range from ¾ to 5 hp. Metal parts of motor protected with rust and corrosion resistant coatings.



Multi-Switch Indicator . . .

. . .available with provisions that allow instrument to be used for 108 stations—*Barber-Colman Co., Dept. HPAC, 1701 Rock St., Rockford, Ill.*

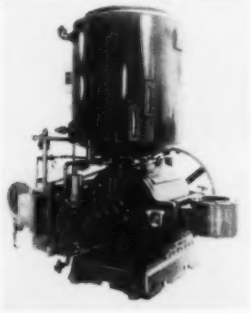
New "9000 Series" multi-switch indicator designed for rapidly checking temperatures at many points. Basic instrument is self-contained, null-balance unit, requiring only external sensing devices. Selector switches are three position spring return type with DPDT action. Unit uses 11 in. scale either single or dual range. Sensitivity is 5 microvolts for scale spans of 5 millivolts; for wider spans it is 0.1 percent. Accuracy is ± 0.25 percent.



Dial Thermometers . . .

. . .designed for piping systems—*Jas. P. Marsh Corp., Dept. HPAC, 3500 Howard St., Skokie, Ill.*

Two types available for piping system applications: direct mounted type for location at point of measurement; distant reading type with 6 ft of capillary tubing. Thermometers are vapor tension type in which varying vapor pressure caused by temperature changes is exerted in Bourdon tube to indicate temperatures. Ranges available: zero to 100 F (for chilled water); 20 to 120 F (for condenser water); 40 to 140 F and 100 to 300 F (for hot water). Dial sizes 3½ and 4½ in.

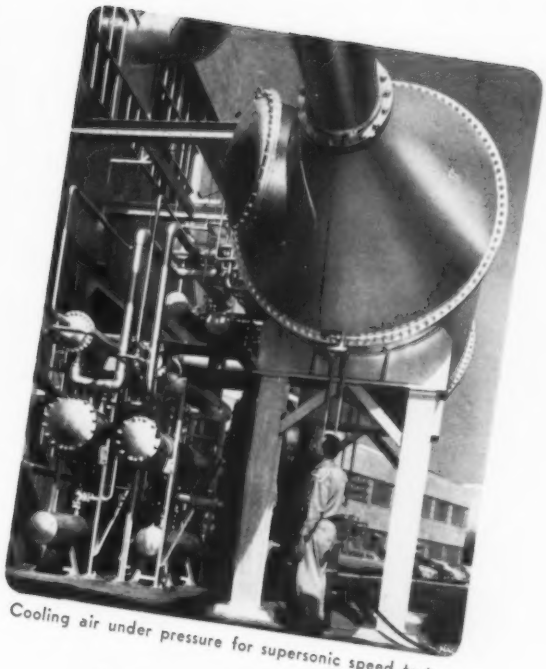


High Vacuum Pump . . .

. . .available in dry, vapor purge, two-stage models for number of vacuum applications—*Beach-Russ Co., Dept. HPAC, 420 Lexington Ave., New York 17.*

"Type RP Rotary Piston, Model 1000" high vacuum pump has 1100 cfm capacity. Said to be extremely quiet in operation, free of excessive vibration. Especially intended for use on large systems which are handled by mechanical pumps only. Unit requires 50 hp motor.

Making dry ice at 109° below zero using standard ammonia compressors in an improved cycle.



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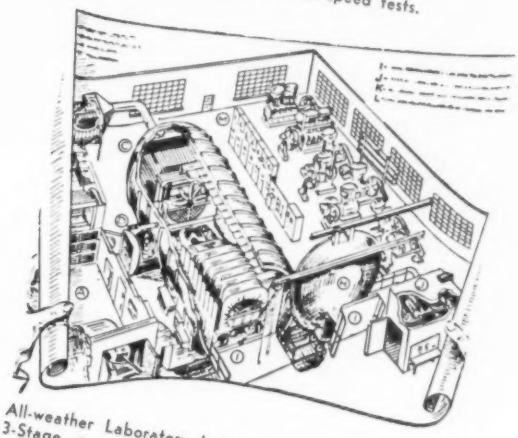
If you need any type of industrial or commercial cooling—for quick freezing, cold storage, ice making, humidity control, low temperatures, condensing, air conditioning, or any process work—contact the nearest Frick Branch or Distributor for recommendations and estimates.



All-weather Laboratory built for U. S. Army. Uses 3-Stage compressors; maintains Arctic, tropic and stratospheric conditions.

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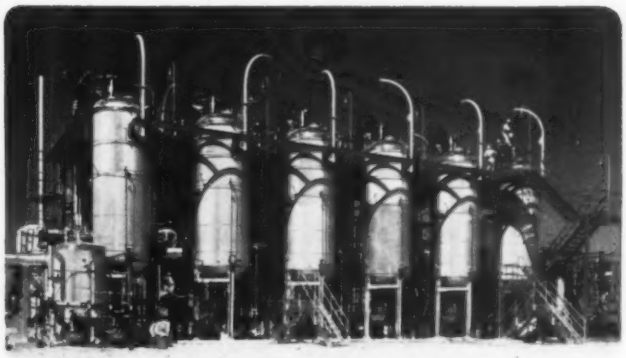
FRICK CO.

WAYNESBORO, PENNA., U. S. A.

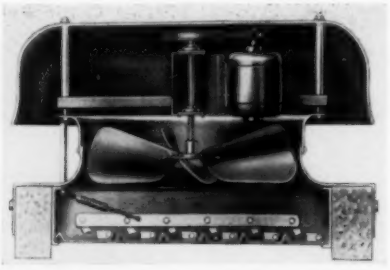
Test laboratory work for temperatures down to 140° below zero.



Frick patented cooling coils and controls have doubled the output of synthetic rubber reactors.

EQUIPMENT DEVELOPMENTS

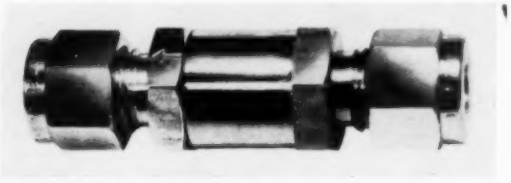
Continued



Roof Ventilator . . .

. . . with deep-pitched aluminum blades designed to deliver high capacity at low rpm—*Loren Cook Co., Dept. HPAC, 227 Depot St., Berea, Ohio.*

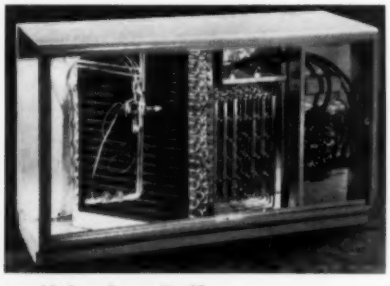
Roof ventilator fan speeds range from 220 rpm on 48 in. model to 690 rpm on 24 in. size. Lightweight construction includes aluminum belt drive power assembly. Available in sizes from 2960 to 18,570 cfm.



Poppet Check Valve . . .

. . . developed for use with wide range of pressures—*Nuclear Products Co., Dept. HPAC, 15635 Saranac Rd., Cleveland 10.*

Major application of poppet check valve is on instrument, process, and control lines to allow flow in one direction, automatically stop flow in reverse direction. Full flow said to be maintained with low pressure drop. Valve is 2⅛ in. from end to end, furnished in brass, stainless steel, monel, aluminum, nylon, other materials on request. Available with "Swagelok" ends or other end connections also.



Air Conditioning Coil . . .

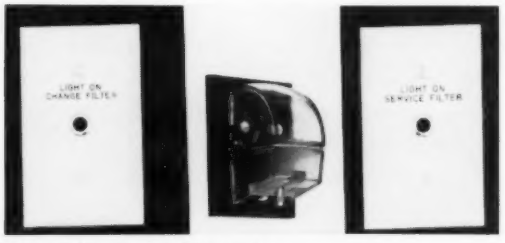
. . . for school applications—*Lennox Industries, Inc., Dept. HPAC, 1701 E. Euclid Ave., Des Moines, Iowa.*

"BCL1-3" Air conditioning coil of 3 ton capacity can be installed in regular 48 in. bookcase section of manufacturer's "Comfort Curtain" system to handle all requirements of air conditioning for average classroom. Heat pump and electric resistance heater, designated "BCPEL-3," may also be installed in system. Regular heat pump coil of 54,000 Btu per hr supplemented by four electric strip heaters of 4 kw each. Maximum output of electric strip unit is approximately 54,800 Btu per hr.

Registers and Grilles . . .

. . . for air conditioning installations—*Lima Register Co., Dept. HPAC, 1790 N. Cable Rd., Lima, Ohio.*

Series of multi-valve grilles, registers made in four sizes: 8 × 6, 10 × 6, 12 × 6, 14 × 6 in. Designed for high and low sidewall applications. "Model 10M" register intended primarily for heating, but can be adapted for cooling applications. "Model 100M" grille has four-way air deflection for complete directional control of air.



Filter Change Signal . . .

. . . developed for installation with any duct system—*Better Engineered Controls, Dept. HPAC, 1822 S. Burlington Ave., Los Angeles 6.*

"Tattle Tale Kits" give signal when air filters should be serviced. Filter gage service switch operated by pressure increase, adjusted when installed to signal need for filter service before filter resistance, reduction in air flow become excessive.

Oil Preheater . . .

. . . provides maximum turbulence—*Wells Mfg. Co., Dept. HPAC, 220 Ninth St., San Francisco.*

Three "Low-Watt Density" immersion heating units banked together in specially designed, electrically welded, pressurized (100 psi) tank. Each heater equipped with individually controlled thermostat, factory preset at 150 F, but adjustable to any required temperature. "Triple Pass" design said to produce maximum intermixing, also eliminate oil stratification. Lower grade fuels preheated to flowing temperature quickly. Heating rate: raises 6 gal of fuel oil 100 F per hr for each 1000 watt input.

HUSSEY
COPPER
The Temperature-Sensitive
Metal for Air Conditioning
THERMAL CONDUCTIVITY
Copper and the low-zinc brasses offer outstanding heat transfer rates. Hussey Copper and brass products have been recognized thermal material for 111 years.
CORROSION RESISTANCE
There's a Hussey copper alloy to meet most every corrosion problem; chemical, heat exchanger, processing equipment, refrigeration apparatus, etc.
STRENGTH
High-zinc brasses, nickel silvers, silicon bronzes and phosphor bronzes can provide tensile strength of up to 105,000 psi.
FORMING FACILITY
Hussey Copper has excellent hot and cold workability characteristics. Whether you bend, stamp, spin or machine, there's a Hussey copper to do your job.
JOINING
Hussey Copper and copper alloys lend themselves readily to soldering, brazing or welding by a variety of methods.
BEAUTY FINISH
Hussey copper is an attractive decorative material itself. It takes plating, anodizing, porcelain enamel and many kinds of finishes economically.

HUSSEY

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

PITTSBURGH (19).....2850 Second Avenue
CLEVELAND (3).....5318 St. Clair Avenue
CINCINNATI (37).....1045 Meta Drive
CHICAGO (18).....3900 N. Elston Avenue
ST. LOUIS (1).....Central Terminal Building
PHILADELPHIA (30).....1632 Fairmount Avenue
NEW YORK, LONG ISLAND CITY (6)...34-39 Thirty-first Street

C. G. HUSSEY & CO.

(Division of Copper Range Co.)
Rolling Mills and General Offices
PITTSBURGH 19, PA.

SEVEN FULLY STOCKED WAREHOUSES

Remote control centers *improved* by new modular electronic components

Modular design permits combinations of *standard* electronic components to meet any temperature and humidity control application . . . easier to install and maintain . . . provides the *best system performance* at the *lowest long-run cost.*

Now through modular design of Barber-Colman remote control center electronic components, system control is improved, flexibility is increased, and appearance improved. Here's how . . .

New Modular Design Electronic Components

Standard, same-sized bridges, amplifiers, sequencers, and compensators installed in standard cabinets in various combinations, provide complete control for any type of system. These modules are easily installed in a remote control center.

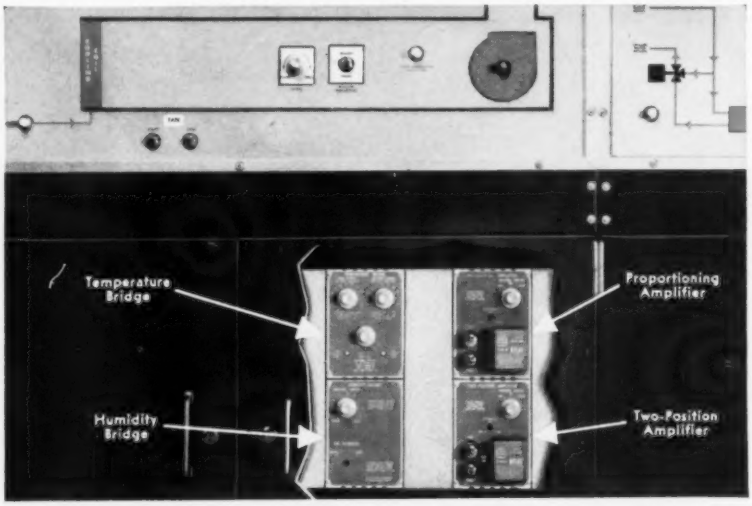
Simplifies System Design and Lowers Initial Cost

By using *standard* components to build up these "controllers," any system can be designed, no matter how large or complex, without resorting to special equipment. Further, because these electronic control components are smaller, a complete remote control center takes up comparatively little room.

Simplifies Installation and Maintenance

All wiring is run to one central point for hookup to the pre-assembled Electronic Control Center. The only remotely located items are the sensing elements and dependable motor operators. All other circuitry is located at the panel where it is easy to get at. *Bridge modules* contain only fixed resistors and potentiometers requiring little or no maintenance.

Amplifier modules use two lightly driven commercial-type tubes and a plug-in microrelay. An override switch provides for manual operation. Override switches on proportioning amplifiers have a "stop" position which permits stopping motor operator anywhere in its stroke.

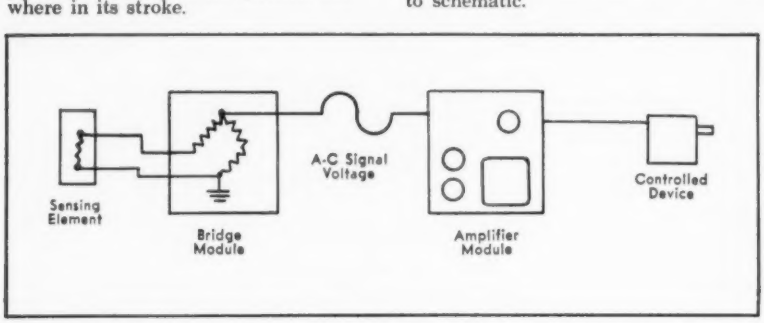


Typical electronic zone temperature and humidity controller shown mounted in a remote control center. The controller is built up from standard, same-sized amplifier and bridge modules. In this installation, provision is made for proportional control of a temperature-regulating device (motor-operated valve, damper, etc), and for two-position control of a humidity-regulating device (motor-operated valve, relay, solenoid, etc.).

All modules employ extra-heavy printed circuitry with terminals arranged for short-jumper interconnection.

Electronic Remote Control

The time-proved basic electronic control system used by Barber-Colman consists of the following: A resistance-type sensing element (remotely mounted), a bridge circuit (cabinet-mounted) to translate any change in current flow from the sensing element into a specific voltage, and an amplifier (cabinet-mounted) to build up this voltage sufficiently to operate a relay (cabinet-mounted), which, in turn, operates the controlled device. Refer to schematic.



Basic control circuit schematic showing single bridge and amplifier modules. The same basic circuit applies to either temperature or humidity control systems. Both temperature and humidity control modules, along with sequencing and compensator modules, may be combined in one controller cabinet. Cabinets are available to hold 2, 4, or 8 modules.

Remote temperature adjustment is standard on bridge modules. It is necessary only to add a remote temperature indication and recording system (new modular bridge) to provide *complete* remote control.

Temperature bridges have provision for three sensing elements making them suitable for systems, amongst others, requiring room, discharge, and outdoor control.

Positive sequencing is provided, using a sequencing bridge or reversing series arrangement. This permits combining heating, ventilating, and cooling in a single year-round system.

Other new compensator bridges provide control system flexibility never before possible with standard components.

For additional information ask for new literature on Modular Electronic Controls. Call your local Barber-Colman field office or write:

BARBER COLMAN **Automatic Controls**

"Better Control . . .Electrically"

BARBER-COLMAN COMPANY

Dept. P, 1301 Rock Street, Rockford, Illinois

New Modular Design Electronic Components

See opposite page for complete story

Listed below are the electronic "building blocks," which, in various combinations, provide unexcelled remote control for any type of air conditioning system. All modules operate on 115-volt, 60-cycle current, have the same over-all physical dimensions, and can be mounted in standard cabinets of 2, 4, or 8 module capacity. Extra-heavy printed circuitry is used, with terminals arranged for easy short jumper interconnection.

AMPLIFIERS

With plug-in microrelay, two commercial tubes, and convenient manual switch.

Proportioning Amplifier Shown

Proportional—used with temperature or humidity bridge for proportional control of motor-operated devices.

Two-position — for "on-off" control of motor-operated devices or solenoids in temperature and humidity control systems.

BRIDGES

Consist of electronic bridge circuit, or circuits, made up of fixed and variable (potentiometer) resistors.

Temperature Bridge Shown

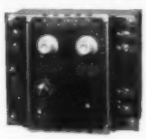
Temperature — up to three sensing elements. Allows remote adjustment.

Humidity — provides precise control.

Sequencing — auxiliary circuit. Takes output from temperature or humidity bridge, and converts it to operate several amplifiers in sequence.

COMPENSATORS

Master—made up of fixed and variable resistors arranged for use with above bridges and amplifiers. Provides resetting of several systems from one element.



Master Compensator Shown

Dual — two compensating bridges on one module. Individual adjustments.

Humidity — single bridge provides resetting temperature from humidity or vice versa.

ASK FOR LITERATURE

BARBER COLMAN

Automatic Controls

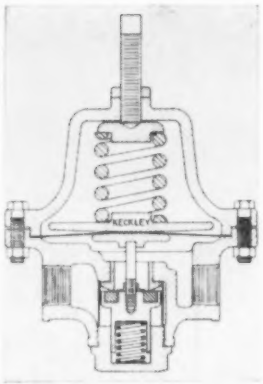
"Better Control . . .Electrically"

BARBER-COLMAN COMPANY

Dept. P, 1301 Rock Street, Rockford, Illinois
Field Offices in Principal Cities

EQUIPMENT DEVELOPMENTS

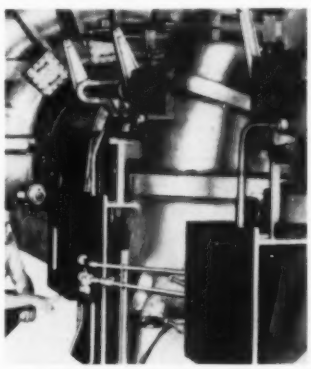
Continued



Pressure Reducing Valve .

. . .engineered for increased flow in steam, air, water, oil, gas applications —*O. C. Keckley Co., Dept. HPAC, 3400 Cleveland St., Skokie, Ill.*

"No. 11A" pressure reducing valve has full ported orifice for high capacities. Single seated unit has semi-steel body, bronze trim, composition disc, suitable for initial pressures to 250 psi. Reduced pressures range from 1 to 100 psi. Interchangeable standard composition discs applied for such services as: steam, air, water, oil, gas. Available in sizes ⅜ to 2 in.



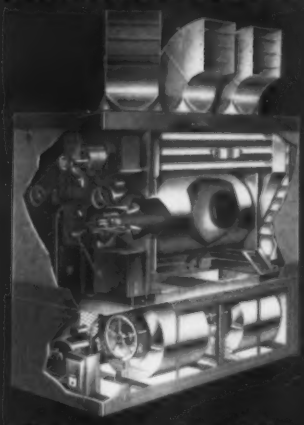
Surge Control System . . .

. . .engineered for large air compressors, blowers, exhausters—*CDC Control Services, Inc., Dept. HPAC, 414 S. Warminster Rd., Hatboro, Pa.*

"CompuDyne" surge control system can be used on units from 50 hp up. Said to be highly flexible, completely packaged system providing safety at any level of compressor operation. System consists of fully-electronic sensing, measurement, control instruments, plus electro-hydraulic or elec-

LENNOX

"OG" SERIES INDUSTRIAL HEATER



Remarkable Adaptability

Efficient heat transfer design results in reduced physical size of this heater . . . allowing it to take up a minimum of space. If floor space is at a premium, the "OG" can be suspended horizontally or inverted. Removable nozzles permit free standing or ducted installations.

DUAL FUEL
Power Burners
Burner operates equally well with either gas or oil. Changeover is instant and automatic.

LENNOX "Task-Matched" Equipment to control and condition air for industry

64,000 to 2,000,000 Btuh

CLIP AND MAIL FOR FREE SPEC SHEETS

LENNOX Industries Inc.
INDUSTRIAL DIVISION
P.O. Box 1294, Dept HP-4
Des Moines 5, Ia.

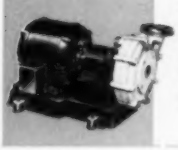
Please send me—without obligation—complete specifications and engineering data on Lennox "OG" Series Industrial Heaters

Name.....
Company.....
Address.....City.....
Title.....

Life in these excited states...

"I got the pot and tubing corrosion licked, but now the jugs won't hold up!"

"WAM" PUMP *finest you can buy*



Highest pumping efficiency, with faultless corrosion resistance. Hard rubber casing and impeller; Hastelloy *C* shaft. 80 gpm. *Bul. CE-55.*

THRIFTY-THROATED VALVES

Liquids never touch metal in Ace diaphragm valves! Rubber or plastic-lined cast iron, or solid plastic bodies. Sizes ½ to 6". Ask for facts.

ACE-ITE *all-purpose toughie*

High-impact, rubber-plastic, most economical for average chemicals. ½ to 6". Screw or solvent welded fittings. Valves ½ to 2". NSF-approved. *Bul. 80A.*

Still bothered by corrosion?

Downtime, ruined equipment, endless repairs are more than disturbing... they're expensive too. You can put an end to 85 to 100% of your corrosion and contamination losses by specifying chemical-resistant Ace rubber and plastic equipment... pipe, valves, tanks, pumps. American Hard Rubber Company's 108 years of experience is ready to help you with any problem.

RIVICLOR *ageless strength*

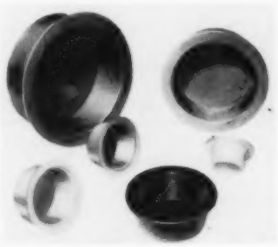
All-purpose rigid PVC. Sched. 40, 80 & 120, ½ to 4". Threaded or socket-weld fittings. Valves ½ to 2". NSF-approved. *Free Bul. CE-56.*

ACE processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY
DIVISION OF AMERACE CORPORATION
Ace Road • Butler, New Jersey

EQUIPMENT DEVELOPMENTS
Continued

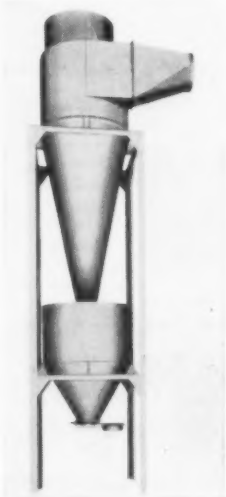
tro-pneumatic actuator and control valve. Electronic instrumentation permits compressors to be operated close to surge point with consequent gains in output.



Plastic Pipe Plug . . .

. . . color coded, with size measurements molded into bottom of each piece—*Protector Products, Inc., Dept. HPAC,* 2144 *W.* 15*th St., Cleveland* 13.

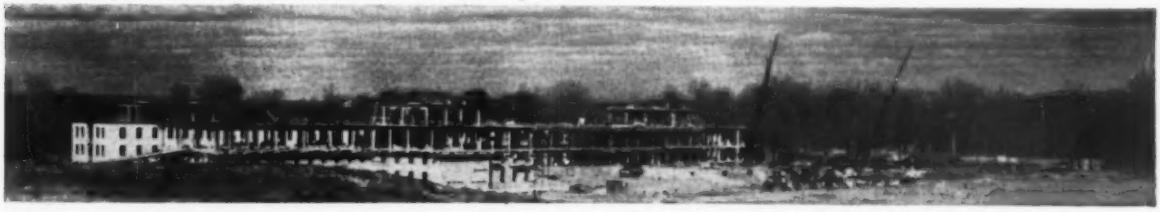
Polyethylene protective plugs tapered on outside wall to match pipe thread surface. Inside wall is vertical for additional wall thickness at points of greatest stress. Suggested applications include: protection of bored, ground, polished, plated or painted internal surfaces; temporary sealing of valve seats, tubes, tube fittings. Available in sizes from ⅛ to 1 in. for all standard internal pipe threads.



Dust Collector . . .

. . . developed to operate in 4000 to 6000 cfm range—*Torit Mfg. Co.,*

The Esso Research Center's 3-story, 600-ft.-long office building includes conference rooms, technical library, correlations and computor center, medical department, cafeteria and landscaped court for its 800 employees. The project was designed and engineered by Voorhees Walker Smith Smith and Haines of New York City. Frank Briscoe, Inc., Newark N. J., is general contractor. August Arace & Son, Inc., Elizabeth, N. J., is mechanical contractor for heating and air conditioning. Alward Construction Co., Bernardsville, N. J., is doing the insulation work.



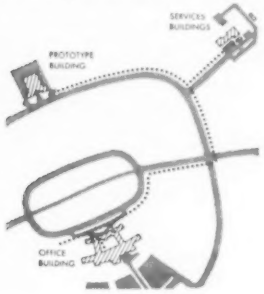
Esso Research Center uses GILSULATE® for insulating mile of underground steam pipes

GILSULATE goes in fast. In the foreground the field inspector checks depth of pour. Directly in back of him, two workmen are shovelpointing and tamping. Other workers are sliding GILSULATE bags into pipe trench while men at rear are placing plywood forms near manhole.

Esso Research and Engineering Company, the scientific and engineering affiliate of Standard Oil Company of New Jersey, is now constructing a modern research center in Florham Park, N. J. To preserve the natural beauty of the 675-acre site, all heating, air conditioning, power and communications lines are run underground.

Steam, at a pressure of 250 lbs. (406° F.), will flow through a 600-ft.-long, 12" welded steel pipe from the boiler room to a manhole where a 1400-ft. string of 10", 8" and 6" pipe will carry heat to the prototype building. Similar piping leaves the other side of the first manhole and runs 2500 feet to the main office building. Trenches also carry 3" to 6" condensate return lines. The system has 24 expansion loops and seven manholes, and includes capped lines for use when facilities are expanded.

Over 500 tons of GILSULATE will be used for insulating and protecting the underground steam pipes. In addition to its low thermal conductivity, GILSULATE resists attack by acids, alkalies and electrical conductivity and provides excellent protection against corrosion. For full information on this low-cost, poured-in-place insulation, see your local GILSULATE distributor, or write our Salt Lake City office.



FACTS ABOUT GILSULATE

1. **EASY TO USE**—just pour, shovelpoint and tamp...pipe heat does the rest.
2. **FORMS 3 ZONES** of protection against heat loss and all hazards commonly encountered by buried hot pipes.
3. **NEEDS NO HOUSING OR MECHANICAL SHEATHS:** no mixing, special handling or equipment.
4. **ONLY NEEDS NORMAL PIPE SPACING:** for multiple pipe or cramped conditions.
5. **THREE TYPES AVAILABLE:**
   Type A for 220-300° F. temp. range
   Type B for 300-385° F. temp. range
   Type C for 385-520° F. temp. range

THE TRIPLE-ZONE INSULATION FOR LIFETIME PROTECTION OF UNDERGROUND HOT PIPES

GILSULATE®

AMERICAN GILSONITE COMPANY

Affiliate of Barber Oil Corp. & Standard Oil Co. of California
Offices at: Municipal Airport P.O. Box 15, Salt Lake City, Utah
3537 Lee Road, Cleveland 20, Ohio
Distributors in Principal Countries of the World

Do you receive Pipe Insulation News? Ask to be put on our mailing list.

COUNT ON SHURE-SET

for quicker, easier fastening on every job

Stops costly, time-consuming pre-drilling, star-drilling, filling and plugging. These steps are unnecessary with versatile Shure-Set, the unique hammer-in fastening tool. Shure-Set requires no cartridge . . . converts hammer strokes into highly efficient power, driving "job-fitted" austempered fasteners into metal, concrete, mortar . . . seating them easier, up to 10 times faster than any other method. Save time and money on all light fastening —look for your dealer's name under "Tools" in the Yellow Pages.

In addition to hammer-in Shure-Set, the versatile Ramset Fastening System includes Ramset powder-actuated tools for heavy-duty fastening, and Ringblaster heavy-duty kiln gun.

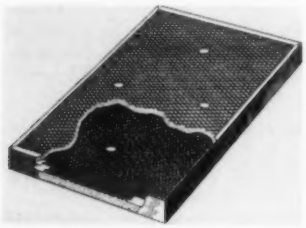
OLIN MATHIESON CHEMICAL CORPORATION
Shure-Set
Ramset Fastening System

WINCHESTER-WESTERN DIVISION • OLIN MATHIESON CHEMICAL CORPORATION
12109-D BEREA ROAD • CLEVELAND, OHIO

EQUIPMENT DEVELOPMENTS
Continued

Dept. HPAC, Walnut and Exchange Sts., St. Paul, Minn.

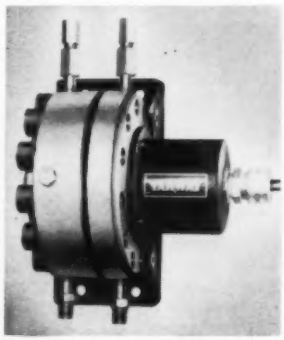
"Model 36" dust collector has adjustable belt drive to give wide range of cfm performances against varying resistances. Designed for outdoor exhaust applications.



Grease Filter . . .

. . . intended to reduce fire, health hazards to minimum—*Extraer, Inc., Dept. HPAC,* 1210 *Chenevert, Houston.*

Three-stage double flame baffle grease filter has following features as cited by manufacturer: higher percentage of grease removed; no back drip; easy cleaning; two filters in one, with air space between. "Elektra" grease filter consists of two filter units in single steel frame, separated by 5/8 in. air space, acting as cooling, solidifying chamber.



Pressure Transmitter . . .

. . . designed to operate without visual indication, control distant indicator, controller, other electrically-operated receiving instrument—*Yarnall-Waring Co., Dept. HPAC,* 107 *Mermaid Ave., Philadelphia* 18.

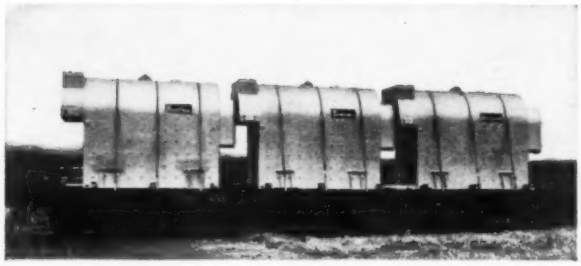
Differential pressure transmitter consists of diaphragm mechanism in pressure housing with pressure connections at bottom, sensing coil which operates remote receiver.

THE BIG ONES COME TO BURNHAM

NASSAU COUNTY OFFICE BUILDING — GARDEN CITY, N. Y.

CHAPMAN, EVANS & DELEHANTY.....*Architects and Engineers — New York City*
V. L. FALOTICO & ASSOCIATES.....*Engineers — Brooklyn, N. Y.*
BERWIND & CO., INC.....*Heating, Ventilating and Air Conditioning Contractors — Garden City South, N. Y.*

BURNHAM'S "COMPACT" STEEL BOILERS HEAT LONG ISLAND'S "OFFICE BUILDING OF THE YEAR"



In shipment, the 3 Compact-Type Boilers, each of 20,000 sq. ft. steam net SBI rating, travel to Nassau County on *one* railroad flatcar. Here's visual evidence of their space-saving compactness.

Considered the largest and finest office building constructed on Long Island, N. Y. in 1958, the ultra-modern Nassau County Office Building uses 3 Burnham Compact-Type Boilers. Proved in 25 years' service, this reliable, highly efficient Burnham design compresses maximum heating capacity into *minimum floor space.* Consider it on your next job where space-saving is important. These welded steel Compact-Type Boilers are available in capacities from 2,600 to 35,000 sq. ft. E.D.R. net steam, SBI, with comparable ratings for water.

Burnham also offers a complete line of *Scotch-Type* and *Scotch-Type Package* Boilers in the above ratings and in certified ratings with up to 4,000 sq. ft. of heating surface.

Burnham Corporation

Steel Boiler Department
Irvington, New York

MEMBER SBI

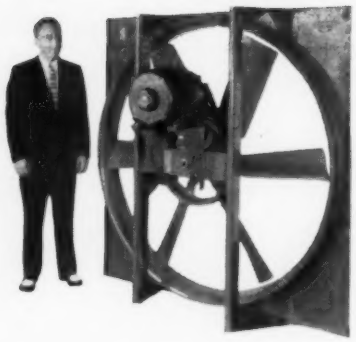
Sales Representatives throughout the U.S.A.

Burnham Corporation HP-49
Steel Boiler Dept.
Irvington, New York

Please send me, without obligation, full ratings and data on:
Compact Boilers ☐ Scotch-Type Boilers ☐ Boiler-Burner Packages ☐

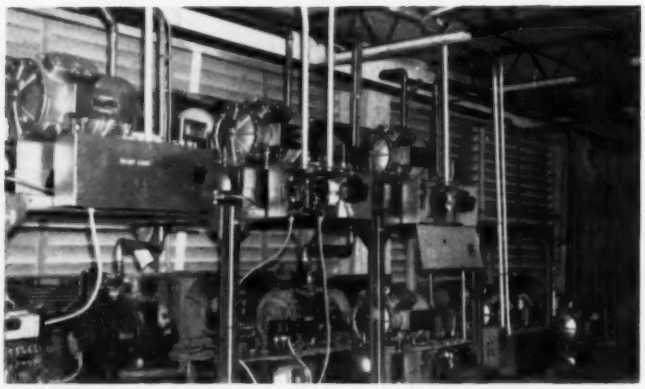
Name .....
Address .....
City ..... State .....

SAVE AT WINN DIXIE FOOD STORES



COOLAIR
Heavy Duty Fans

Keep Winn-Dixie compressors operating at peak efficiency



Winn-Dixie is one of the Southeast's largest food chains—over 500 stores in 10 states. Air-cooled compressors like the ones shown in the photo are a vital part of supermarket food refrigeration and air conditioning equipment.

Winn-Dixie specifies Coolair ventilating fans to keep the compressors working at peak efficiency in its stores. These fans have the rugged dependability necessary for the job.

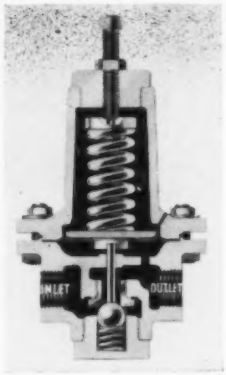
Factory-trained sales engineers in all principal cities are available for consultation on any ventilation or cooling problem. Write for the location of our sales office in your city or consult the yellow pages of the phone book.

American Coolair Corporation
P. O. Box 2300, Jacksonville 3, Florida

SEE OUR CATALOG IN SWEET'S
INDUSTRIAL CONSTRUCTION FILE

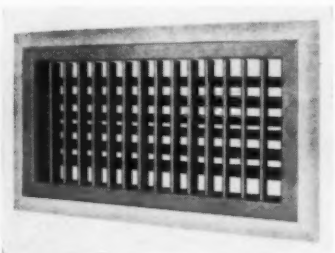
Charter Member Air Moving and Conditioning Association

EQUIPMENT DEVELOPMENTS
Continued



Pressure Reducing Valve .
. . .designed to control steam, water, air, non-toxic non-flammable gases—*Clark Mfg. Co., Dept. HPAC,* 1830 *E. 38th St., Cleveland* 14.

"RVA" pressure reducing valve made from semi-steel body with hardened stainless steel valve seat. Valves intended to reduce higher pressure to lower pressure automatically and hold constant reduction despite changes in pressure in high pressure line. Suitable for initial pressures to 250 psi at 450 F, and 300 psi at 200 F. Threaded cap allows interchange of adjusting springs for different pressure requirements. Springs available for both models with reduced pressure ranges from zero to 20, 10 to 50, or 40 to 125 psi.



Grilles . . .
. . .with removable cores, separable frames—*Waterloo Register Co., Inc., Dept. HPAC, P. O. Box* 72, *Waterloo, Iowa.*

Free area maintained by frame design permitting removal of grille core without removing separable frame. Cores can be removed for cleaning or refinishing without removing outer frame. Frames made of corrosion

kitten quiet...

easiest to keep clean...

...and the

heat exchanger is

PROTECTED BY *Jetglas* -C

DAY & NIGHT UNIT HEATER

Missile nose-cone durability has given birth to important by-products like **Jetglas-C,** the miracle protection for heat exchangers on Day & Night unit heaters. Can't burn out, can't rust out, can't wear out! Add that to design advantages that provide for easy installation, easy cleaning and maintenance, super-quiet and efficient operation—and you have the finest unit heater on the market today. For complete information, write to:

DAY & NIGHT MANUFACTURING CO.

855 Anaheim-Puente Rd. • La Puente, Calif.

The Packaged Answer to Scotch Marine Boiler Firing Problems

New Mettler "Turbo-Flame" forced draft burners provide efficient combustion against back pressures up to .5" w.c.

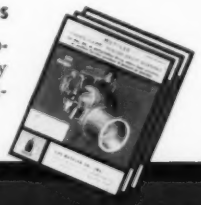
A completely automatic combustion system—specially designed for Scotch Marine Boilers 22 to 126 hp

For Gas, Oil or Combination Firing

- Completely packaged . . . nothing else to buy or install
- Tested and adjusted for job-site conditions prior to shipment
- Built to exceed standards of all approval agencies
- 100% shutoff in event of flame or power failure
- Air register closes automatically during "off" cycle for maximum operating economy
- True modulation on gas firing
- Fingertip change-over on combination gas/oil units
- Fast deliveries of customized units

WRITE FOR NEW CATALOGS AND SPECIFICATIONS

Bulletin GO-300-B describes exclusive "Turbo-Flame" features. Bulletin GO-300-S and capacity chart GO-300-A provide complete capacity specifications for various operating conditions.



METTLER

Eclipse

THE METTLER CO., INC.

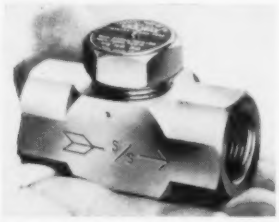
Division of ECLIPSE FUEL ENGINEERING CO.

1139 Buchanan Street, Rockford, Illinois

EQUIPMENT DEVELOPMENTS

Continued

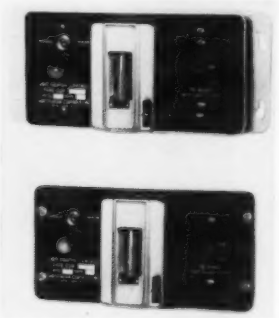
resistant aluminum. All aluminum construction or aluminum frames with conventional cores may be specified.



Steam Trap . . .

. . . engineered for light condensate load applications—*Yarnall-Waring Co., Dept. HPAC,* 107 *Mermaid Ave., Philadelphia* 18.

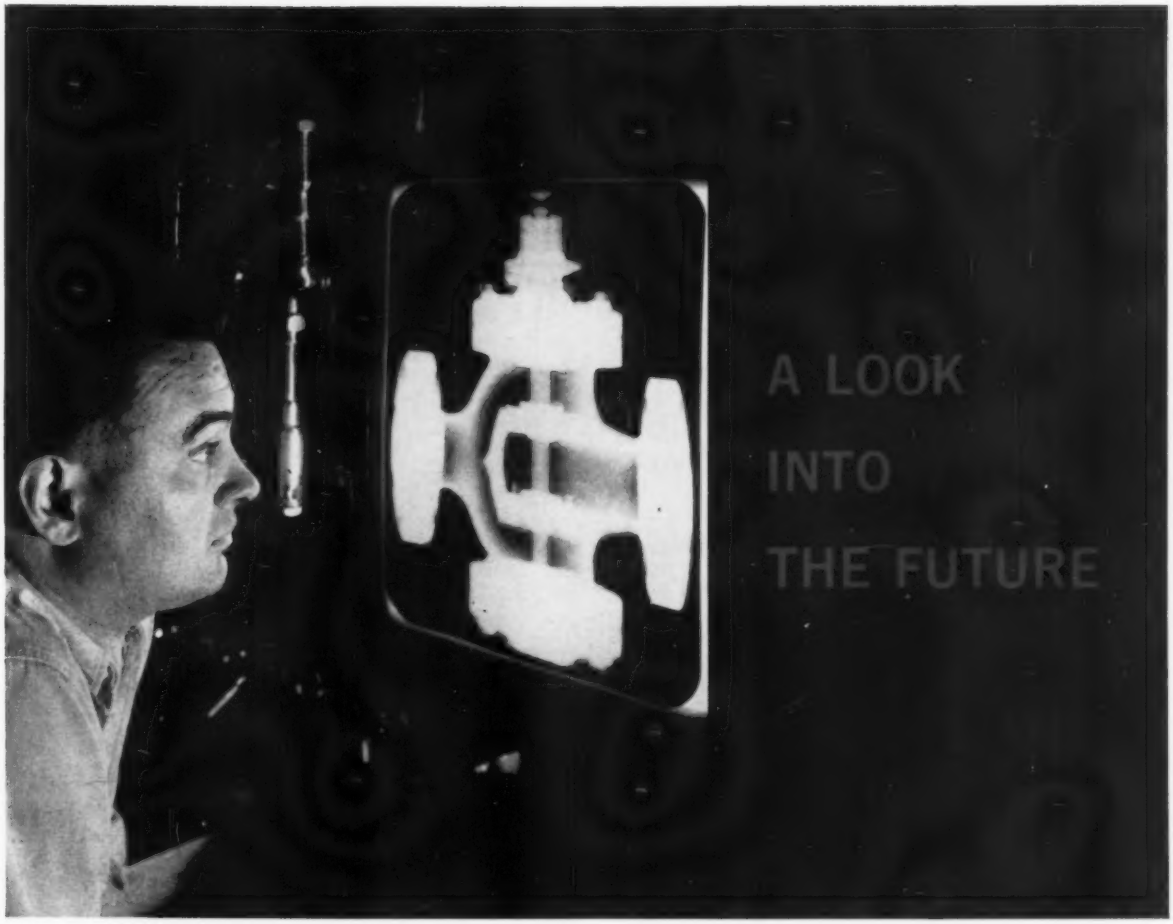
"Yarway No. 30" impulse steam trap has lever-type valve, which pivots about fulcrum, discharges air, condensate at full capacity at startup time and snaps shut when steam reaches trap, providing closer shut-off. Unit has replaceable valve seat assembly, one moving part, stainless steel construction. Trap available in ½ in. size only for operating pressures 8 to 600 psig.



Unit Heater Control . . .

. . . in small, compact, combination design—*Sarcotherm Controls, Inc., Dept. HPAC,* 635 *Madison Ave., New York* 22.

"Type CUH" combination unit heater control includes accurate line voltage thermostat, manual starter with thermal overload protection, summer-winter switch to permit fan operation alone in summer, pilot light indicator for fan operation, terminal block accommodating line to service fan motor, optional low limit aquastat or pressurestat.



Neither stargazer nor mystic, this K & M technician can nevertheless see into the future. His crystal ball is a small mass of radioactive Iridium; his fortune-telling cards, gamma-ray pictures of critical valve assemblies. With these pictures he searches out the kind of subtle flaws and tiny imperfections that could become trouble spots at some future time. And so he is able to predict and prevent in-service failures and malfunctions.

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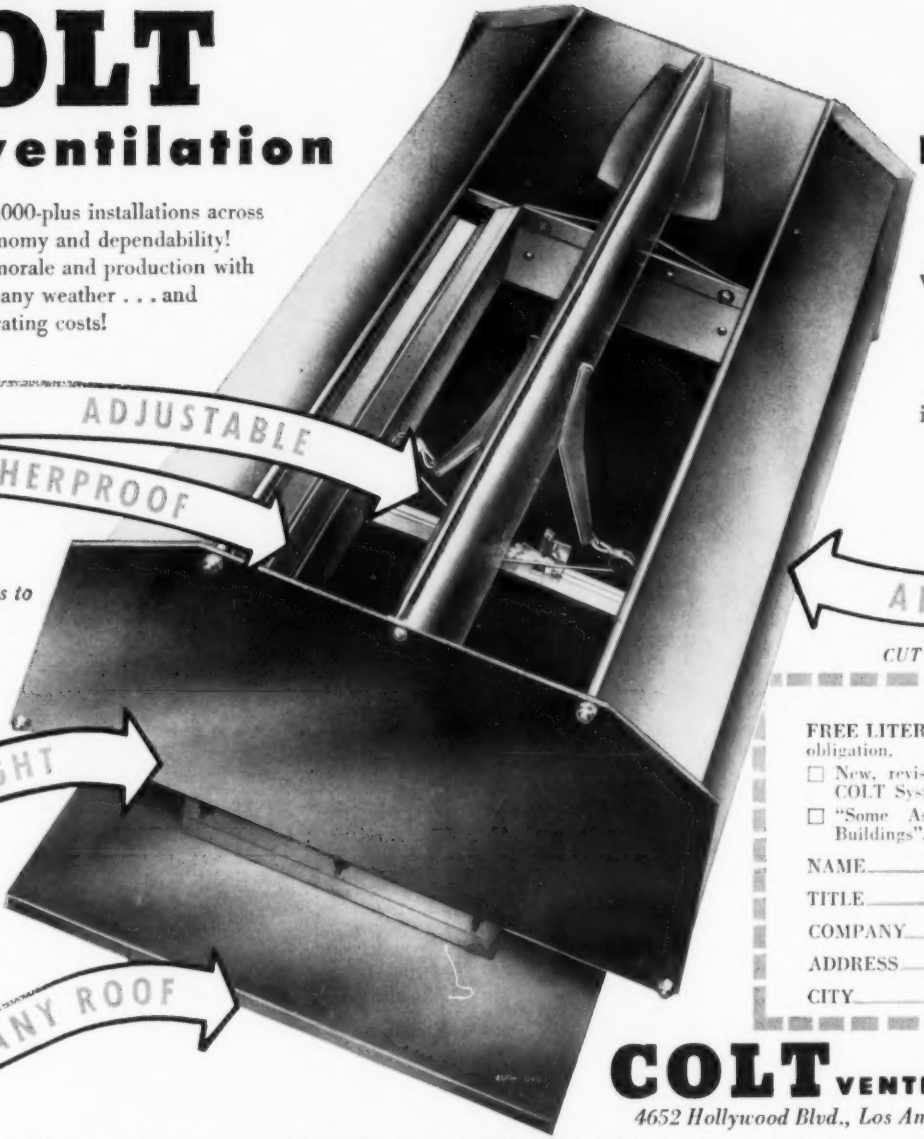

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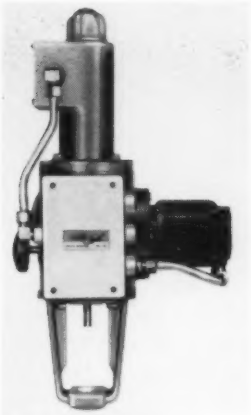
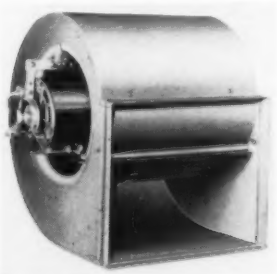
EQUIPMENT DEVELOPMENTS
Continued



Valve Actuator . . .

. . . developed to provide automatic or remote manual positioning for throttling control of many types of valves, dampers, louvres, metering pumps, changers—*Conoflow Corp., Dept. HPAC*, 2100 *Arch St., Philadelphia* 3.

"Model D-62XW" gives proportional positioning by means of slidewire feedback used in conjunction with one of several voltage balance systems. Available in variety of travels from ½ to 4 in., with maximum thrust of 700 lb. Stroking speeds are 8½ in. per min at 100 lb load to 2½ in. per min at 700 lb load.



Direct Drive Blower . . .

. . . developed for air conditioning applications—*Lau Blower Co., Dept. HPAC*, 2027 *Home Ave., Dayton* 7, *Ohio.*

New 10 in. direct drive blower with ½ hp motor will move air at maximum rate of 2550 cfm at static pressure of 0.55 in. water gage, and a minimum rate of 1000 cfm at 1.2 in. WG. Blower wheel of aluminum construction. Measures 13⅛ in. across, with additional 2½ in. for bracket mounting, and 17⅜ in. high.

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SPECIFY "weil"

weil Submersible Sewage and Sump Pumps have been in use since 1951. There is no substitute for experience.

NOW AVAILABLE in a choice of two motors

1750 R.P.M. and Low Speed 1140 R.P.M. for longer life, less wear and improved non-clog characteristics.

NOW AVAILABLE with a choice of two controls

Conventional float switch

MICRO Pressure switch (as illustrated)

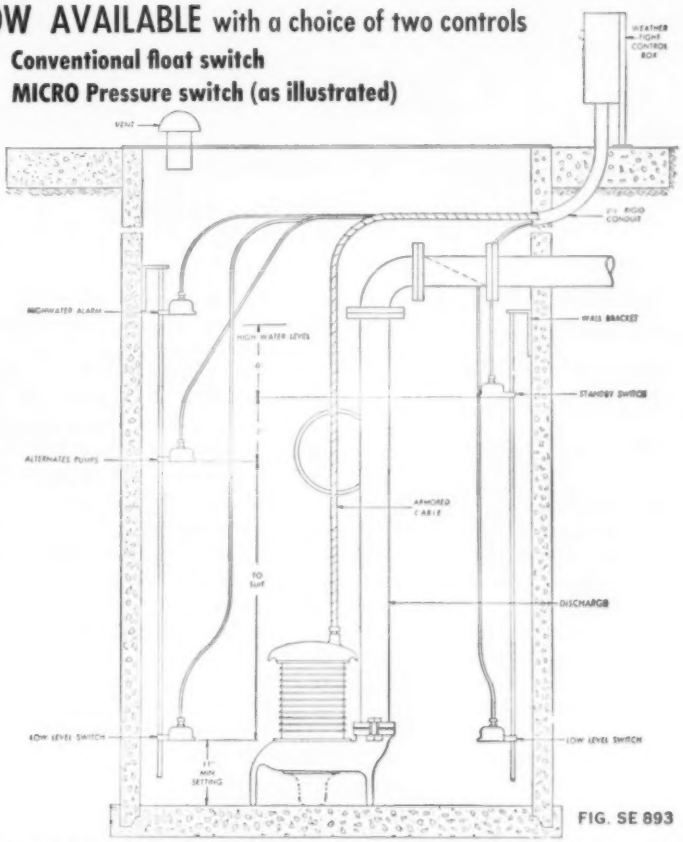

FIG. SE 893

Illustrated is a Duplex Installation of two **weil** Submersible Sewage Pumps employing MICRO Switch controls to start and stop pumps; to alternate pumps; and to provide for high water alarm. Note the ease with which switches are positioned (or changed) to control water levels. The Submersible MICRO Switch has no exposed moving parts, needs no servicing and coupled with the **weil** Submersible Pump provides an extremely efficient non-clog trouble-free pumping system.

weil Submersible Pumps are manufactured in discharge sizes of 3" to 6" and capacities to 2000 G.P.M. There is a **weil** Submersible Pump to meet all requirements. **Now approved by the CANADIAN STANDARD ASSOCIATION Testing Laboratories.**

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Spotless boiler room with fully modulated CB boilers has been termed by visitors "the most beautiful we've ever seen." Stress is on automatic operation from winter heating to summer cooling.

MODERN as the buildings they heat . . .

Two compact, efficient, automatic CB boilers heat five new buildings for International Minerals and Chemical Corporation

Precision and quality are a must for this company which produces minerals and chemicals for industry and agriculture. It's an attitude that carries over to the equipment they buy. That's why they installed two 100-hp Cleaver-Brooks boilers to heat their dramatic new headquarters at Skokie, Ill.

According to Callix E. Miller, A.I.A. Project Manager for IMC, "Our Cleaver-Brooks automatic packaged boilers are efficient and quiet." He added, "Their styling and performance are in keeping with functional design that characterizes our new headquarters."

W. J. Mullineaux, Plant Engineer, reports, "Cleaver-Brooks four-pass, forced-draft design has proved it can keep our operating costs low. The CB boilers fit in well with the automatic system we have and simplify our entire operation. Hinged doors make routine inspection easy."

Architects and Engineers on the job were Perkins and Will. Builder was Turner Construction Company.

For complete information on Cleaver-Brooks packaged boilers like those installed at IMC, contact your representative or write direct to Cleaver-Brooks Co., Dept. D,313 E. Keefe Ave., Milwaukee 12, Wisconsin, U. S. A.

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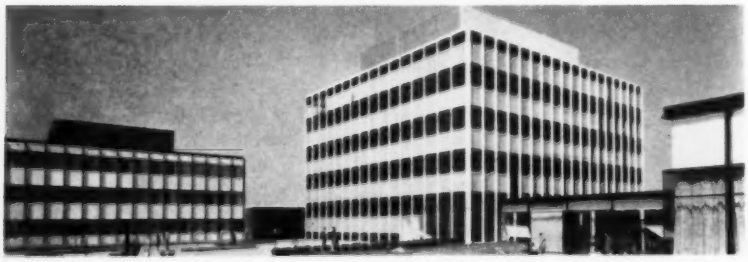
ORIGINATOR AND LARGEST PRODUCER OF PACKAGED BOILERS

IMC headquarters buildings that are heated by CB boilers include the operations building and annex, administrative building, and employees' lounge-cafeteria.



EQUIPMENT DEVELOPMENTS

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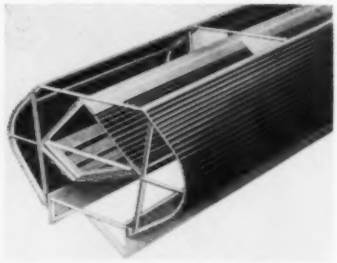

Gravity Roof Ventilators . .

. . .engineered for large volume exhaust from buildings where large furnaces, other heat or fume creating equipment is used in production—*E. Van Noorden Co., Dept. HPAC,* 122 *Magazine St., Boston* 19.

"Sleek Line" continuous gravity roof ventilators available in throat sizes 36 to 96 in., capable of exhausting up to 12,000 cfm for each 10 ft of length. Designed to operate regardless of wind direction, engineered to withstand hurricane, wind, snow load. Available in choice of materials.

Relief Valve . . .

. . .in large capacity design—*Watts Regulator Co., Dept. HPAC,* 10 *Embankment St., Lawrence, Mass.*

"No. 340" relief valve equipped with test lever and has 1½ in. female inlet and outlet connections. Features cited by manufacturer: all bronze construction; guideless stickage-free seating design; ASME steam pressure rating: 5,707,000 Btu per hr at 125 psi; temperature water rating: 3,500,000 Btu per hr.

This seal solves them all . . .

THIS UNIT HAS BEEN CERTIFIED AS COMPLYING WITH • ARI STANDARD 210 •
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. . . ALMOST

The ARI Seal of Certification appearing on unitary air-conditioning equipment certifies that the unit's rated capacity is in accordance with ARI Standards.* This means that all units bearing the seal can be compared on a standardized basis. It means that you can now specify with assurance. It means that you can quote capacity ratings to a customer, knowing the facts are backed up by:

1—the reputation of the industry's trade associations,

2—the results of an independent testing laboratory, and

3—the good name of the manufacturer whose product you offer.

but . . .

As a dealer-contractor, it's still up to *you* to make the necessary measurements, computations and calculations.

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The Seal of Certification doesn't solve these problems for you.

It *does* solve the problem of determining which units meet your specifications.

And, since these units will do the job your specifications call for, you're spared the additional problems of complaints, service calls, dissatisfied customers, and mounting expenses for repairs or replacement of equipment.

*"Unitary" air-conditioners: Packaged air-conditioners, whether single units or combined units (called "split" systems), but not including room air-conditioners or heat pumps. ARI Standard 210-58 for electrically-driven equipment; ARI Standard 250-58 for heat-powered equipment.

The following manufacturers are participating in the program: Airtemp Division, Chrysler Corporation • Amana Refrigeration, Incorporated • American Blower Division of American Radiator and Standard Sanitary Corporation (American-Standard Industrial Division) • American Furnace Company • Arkla Air Conditioning Corporation • Armstrong Furnace Company, Division of National Union Electric Corporation • Bryant Manufacturing Company, Division of Carrier Corporation • Carrier Corporation • Columbia Specialty Company, Incorporated • Coolerator Division, McGraw-Edison Company • Curtis Manufacturing Company • Day and Night Division, Carrier Corporation • Fraser and Johnston Company • Friedrich Refrigerators, Inc. • Frigidaire Division, General Motors Corporation • Gaffers & Sattler, Division of Utility Appliance Corporation • General Electric Company • Gibson Refrigerator Company, Division of Hupp Corporation • Grove Furnace, Inc. • Hall-Neal Furnace Company • International Heater Company • Janitrol Heating and Air Conditioning Division, Surface Combustion Corporation • Lennox Industries, Inc. • The Majestic Company, Inc. • The Mathes Company, Division of the Glen Alden Corporation • Mueller Climatrol, Division of Worthington Corporation • National-U. S. Radiator Corporation • The Payne Company, Division of Carrier Corporation • Peerless Corporation • Perfection Industries, Division of Hupp Corporation • Rheem Manufacturing Company • Round Oak Company of Indiana, Incorporated • A. O. Smith Corporation • Southwest Manufacturing Company • Therm-Air Manufacturing Company • The Trane Company • Typhoon Air Conditioning Company, Division of Hupp Corporation • United States Air Conditioning Corporation • Westinghouse Electric Corporation • Worthington Corporation • York Division, Borg-Warner Corporation

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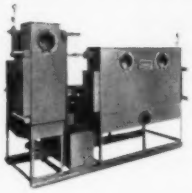

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Surface

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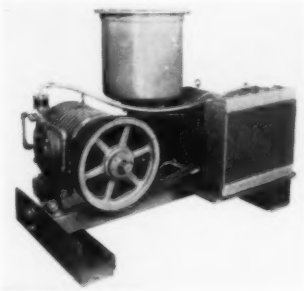
Aluminum Pipe . . .

. . .combining thin walls with standard wall thickness at pipe ends—*Aluminum Co. of America, Dept. HPAC,* 1501 *Alcoa Bldg., Pittsburgh* 19.

"Unistrength" one-piece pipe said to be adaptable to all joining methods. By decreasing wall thickness of weldable, heat treated alloys, except at joints, 40 percent weight saving is achieved. Ratio of thick to thin walls selected to provide uniform bursting, tension, bending strength along pipe's length after welding. Pipe in 40 ft lengths available in alloys 6063-T6 and 6061-T6, with Schedule 40 wall thicknesses at ends, permitting use of standard aluminum fittings, flanges.



Vacuum Pump . . .

. . .with six sets of dual vanes for positive high-pressure oil seal and a patented radiator oil-cooling system —*Leiman Bros., Dept. HPAC,* 102 *Christie St., Newark* 5, *N. J.*

"Model 106" high vacuum pump unit provides steady vacuum of 29.9 in. Hg in continuous operation at average temperature of 200 F. Has capacity of 50 to 105 cfm. Pump's lower temperature operation permits speeds to 800 rpm. Unit dimensions: 47 in. long, 36 in. high, 26 in. wide.

Check Valve . . .

. . .designed to close automatically as soon as fluid flow ceases—*Combination Pump Valve Co., Dept. HPAC,* 851 *Preston St., Philadelphia* 4.

Stainless steel valve disc is center guided above, below to give balanced lift. Stainless steel spring engineered to close valve at instant forward flow

Specify ADSCO SLIP-TYPE EXPANSION JOINTS

- ¾" Diameter and larger
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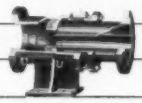

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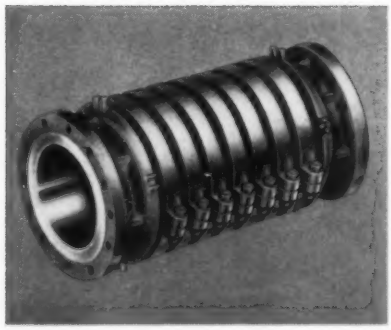

Adsco *Corruflex* Packless Expansion Joints compensate for every possible combination of pipe motion – axial expansion and contraction, lateral deflection and angular rotation. As the *only* manufacturer of both slip and packless expansion joints, Adsco can recommend the type which is best suited for the demands of the job – your assurance of complete satisfaction, utmost economy.

The finest piping work can be no better than the expansion joints used to compensate for expansion and contraction caused by changes in pipeline temperatures. For this reason more Adsco Slip-Type Expansion Joints are specified today than all other makes combined!

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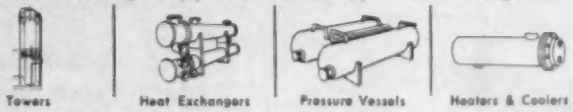

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EQUIPMENT DEVELOPMENTS
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stops. "CPV Silent Steel" check valves available in two types in sizes from 2 to 12 in. diam for pressure ratings from 150 to 2500 psi. Intended for all temperature ranges, including high temperature hot water heating systems.

Radiator Valve . . .
. . . developed specifically for installation on convector radiators—*Marsh Valve Co., Dept. HPAC, Fourth St. and Brigham Rd., Dunkirk, N. Y.*

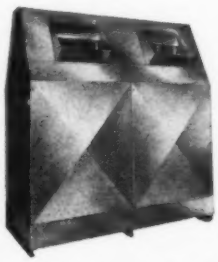
"CF-151" convector female union steam angle available in 1 and 1¼ in. sizes. Unit has female pipe end and female union coupling. Boss lugs at female inlet connection expedite fast positive wrenching. At outlet female union, lug guides situated inside.

Fuel Oil Unit . . .
. . . capable of maintaining 40 gph firing rate—*Sundstrand Hydraulic Div., Dept. HPAC, 2210 Harrison Ave., Rockford, Ill.*

"Model H-7" two stage fuel unit developed for commercial-industrial burners using No. 1, 2, or 4 fuel oil.

Marley Aquatowers®

"The world's most popular packaged water cooling towers" are available in 14 models with capacities upward from 3 tons. From every standpoint —simplicity, economy, maintenance, durability and proven performance— there is nothing like an Aquatower. Lifetime wood filling and steel components, hot dip galvanized after fabrication typify the built-in quality for which Aquatowers are famous.



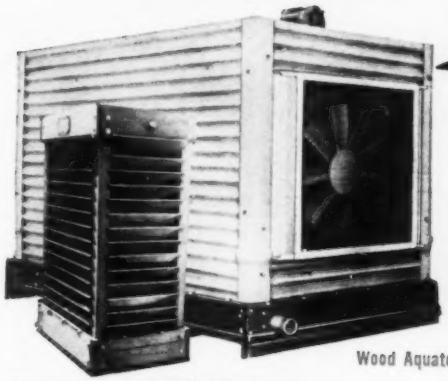
Marley AquaCoolers®

In minimum installed plan areas, indoors or out, AquaCoolers offer full capacity performance and leak-proof, whisper-quiet operation. Basins, casings and centrifugal blowers are hot dip galvanized after fabrication. Marley nozzles and wood filling provide maximum water break-up and air-water contact. Capacities range from 5 to 60 tons, nominal. Smaller models ship completely assembled; larger, in two sub-assemblies.

MAR

Do Your Specs Call for "WOOD COOLING TOWERS?"

Marley Makes 'em All



SpraTowers

Wood Aquatowers

Permatowers

SPRATOWERS®

For lowest original cost and maximum operating economy select all-redwood Marley Natural Draft SpraTowers. These ruggedly constructed towers feature Marley-designed non-clog spray nozzles for assured consistent high cooling efficiency. SpraTowers are available in capacities from 3 tons up—preassembled basins on all models up to 15 tons minimize erection time and expense. Piece-marked components and easy-to-follow instructions speed assembly.

WOOD AQUATOWERS®

Forced draft design and vertical air discharge permit these towers to be installed where towers of other designs cannot be applied. Corrosion-resistant materials — long-life redwood framing, asbestos cement board casing and hot dip galvanized steel components, minimize maintenance and assure long service life. Wood Aquatowers are shipped unassembled. Easy-to-follow erection instructions facilitate fast assembly. Rugged mechanical equipment is designed for long service with minimum maintenance. Five models with capacities from 20 to 50 tons, nominal.

PERMATOWERS®

For dollar-saving durability select the tower with the greatest resistance to corrosion — Permatower. Materials used in Permatower construction, including reinforced polyesters, phenolic and ABS copolymer type resins and protected laminates, assure long tower life under the most severely corrosive conditions.

Permatower's design and operational features are equally unique. Marley's performance-proved Double-Flow design, in packaged towers found exclusively in Marley products, provides peak cooling efficiency with operating simplicity and economy. Permatower's vertical air discharge adds two other outstanding advantages —quiet operation and suitability for location in confined areas. Industrial type mechanical equipment is designed for lasting service with minimum maintenance. Simplified internal piping assembly and water distribution system minimize installation time and expense.

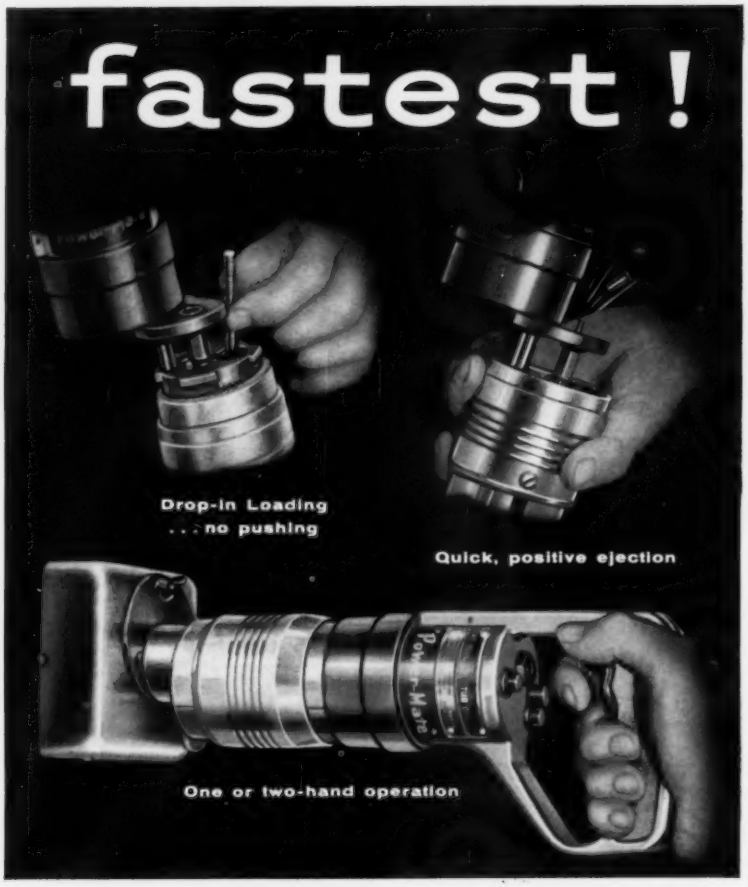
Select from 11 Permatower models with capacities ranging from 5 to 75 tons, nominal.

RLEY

The Marley Company

Kansas City, Missouri

Remington Stud Driver



Loads in seconds . . . sets up to 9 studs a minute in concrete or steel

Here's the most efficient powder-actuated fastening tool ever designed. It's the new Remington Stud Driver with an *exclusive* combination of features that make it your best buy.

Built for speed, it has fast, easy drop-in loading. With Remington "Power-Guide" studs, no ramrod pushing of stud is necessary. Quick, positive ejection is another timesaver. A flip of the wrist and the fired cartridge pops out. With other tools the chamber bushing must be removed by hand, which is clumsy and slow. And only the Remington Stud Driver can be converted to one- or two-hand operation. No other tool has this feature.

Other advantages: Easy, fan-type opening and closing of tool and instantly interchangeable guards for greater versatility, efficiency.

Send coupon for special booklet that proves why the Stud Driver is the fastest powder-actuated tool—and best for you.

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AIR • ELECTRIC • GASOLINE AND POWDER-ACTUATED MODELS

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Remington Arms Company, Inc., Bridgeport 2, Conn.
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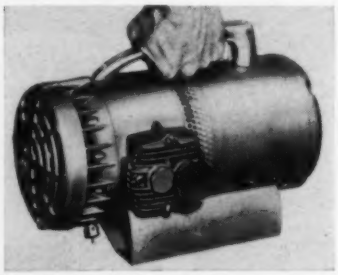
Remington Arms Company, Inc., Bridgeport 2, Conn.
Please send—without obligation—catalogs on Remington Contractor & Industrial Tools checked below:
☐ Stud Drivers ☐ Air Tools ☐ Chain Saws
☐ Concrete Vibrators ☐ Electric Tools ☐ Flexible Shaft Machines
*Name*_____ *Position*_____
*Company*_____
*Address*_____
*City*_____ *Zone*___ *State*_____

EQUIPMENT DEVELOPMENTS
Continued

Intended for use on two-pipe installations with vacuum to 20 in. Hg when mounted with valve underneath.



Air Sampling Pumps . . .

. . . designed as continuous duty vacuum source for use in plant safety and air pollution studies—*Gelman Instrument Co., Dept. HPAC, 233 Jefferson St., Chelsea, Mich.*

Vacuum pump activated by graphite ringed pistons which give volumetric flow over wide range of conditions. Choice of air capacity: 2 cfm or 4 cfm. All bearings greased, sealed; no oil needed.

Limit Control . . .

. . . operated by bimetal element mechanically attached to operate a normally closed SP-ST hermetically sealed mercury switch—*Mercoid Corp., Dept. HPAC, 4201 Belmont Ave., Chicago* 41.

When pre-selected limit temperature on "Type MX-51R" reaches set point, mercury switch circuit opens and remains open; externally operated manual reset knob arranged to reset mercury switch after high operation and normal temperature restoration. Operating range 50 to 650 F; minimum differential 20 F. Electrical rating: a-c or d-c; 10 amp, 115 volt; 5 amp, 230 volt.

Big warehouse keeps warm with four heaters

This 79,000 square foot warehouse of the C. A. Turner Company, Rankin, Pa., has high roof areas and large access doors. Yet, only four Dravo *Counterflo* heaters were needed to maintain a 68° comfort level during last January's severe cold spell with its frequent sub-zero temperatures. Fuel costs for the month were 7/10¢ per square foot!

More than 20,000 Dravo heaters, in use throughout the world, provide this same low cost heating in manufacturing plants, schools, commercial and public buildings. A factory-trained organization handles service on 24-hour call.

Are you paying for inadequate, obsolete or inefficient heating? A Dravo engineer will evaluate your present system now at no obligation. For information on this, or any of the other services and products pictured below, write DRAVO CORPORATION, PITTSBURGH 25, PENNSYLVANIA.

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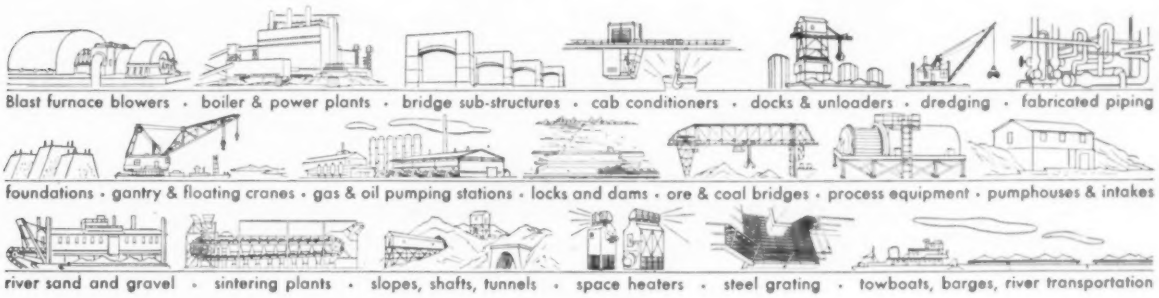
Blast furnace blowers • boiler & power plants • bridge sub-structures • cab conditioners • docks & unloaders • dredging • fabricated piping
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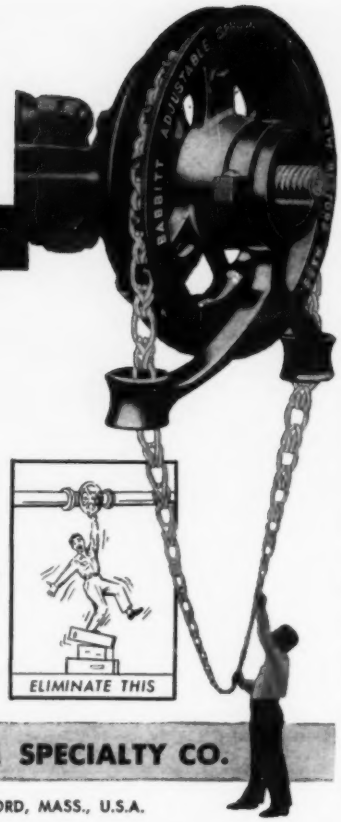
Safe Operation of Overhead Valves with a

Babbitt

Adjustable
SPROCKET RIM
with Chain Guide

- Simplifies pipe layout
- Fits any size valve wheel
- Easy to install and operate
- Operates any valve from plant floor
- Time and money saving fixture
- No maintenance; first cost only cost
- Packed, completely assembled, one to a carton
- Hot galvanized, rust-proof chain available for all sizes
- Easy to follow instructions with each unit
- Your supplier carries complete stocks
- Write for new descriptive catalog sheet and prices



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FAST, ACCURATE

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H&M PIPE CUTTING & BEVELING MACHINES

H&M Pipe Cutting and Beveling Machines provide quick, efficient, automatic preparation of pipe for welding . . . with savings up to 50% over the cost of manual cutting. Lightweight H&M Machines are easily operated by one man and even inexperienced operators give excellent results after only a few minutes instructions on an H&M.

The H&M line, with seven models for 1½" thru 36" pipe, is the right way to put more profit into your pipe cutting operations. Contact H&M for full details.

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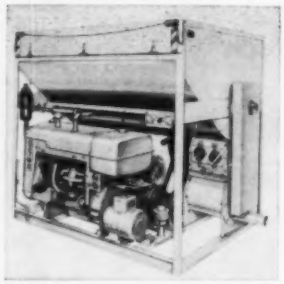
EQUIPMENT DEVELOPMENTS

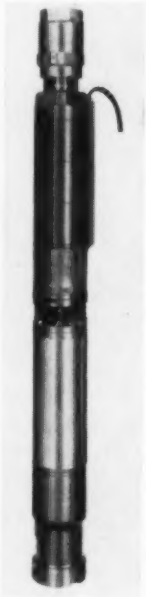
Continued



Insulation Blower . . .

. . . in automatic, completely self-contained design—*Universal Insulating Machine Co., Dept. HPAC, Van Wert, Ohio.*

"Model IH-49 Ultra-Matic Deluxe" insulation blower has built-in secondary magnetic clutch designed to cut time, labor, make possible one-man operation. Unit also incorporates 1200 watt generator to deliver power necessary for truck, lighting, operation of power tools.



Deep Well Pump . . .

. . . designed for 6 in. wells to pump from depths to 600 ft—*Red Jacket Mfg. Co., Dept. HPAC, 1051 S. Rolff St., Davenport, Iowa.*

"Model H Submerga" pump rated at 130 gpm, has capacity range up to 225 gpm. Available with five motor sizes: 5, 7½, 10, 15, 20 hp, and with 3, 4, 5, 8, 10 stages to meet

SILENCE
on the air

WRC, WRC-TV BUILDING, Washington, D. C.
General Contractor: Joseph F. Nebel
Architects and Engineers: Chatelain, Gauger & Nolan
Mechanical Contractor: W. G. Cornell Company, Inc.

FOR A MODERN RADIO AND TELEVISION CENTER
Marlo EQUIPMENT PROVIDES
COMFORT, QUIETNESS AND FLEXIBILITY

Comfort conditioning a television center places two extraordinary demands on the air conditioning system. First of all, it must be *quiet*—free from rattles, squeaks, rustles and other noises that supersensitive microphones could pick up.

Multi-zone unit

Next, it must be *flexible*—adaptable to differing environments: telecasting areas with batteries of heat-producing spotlights; film storage vaults, where temperature and humidity must be closely controlled; and general offices, where normal heat-load conditions prevail.

In the new WRC and WRC-TV building, NBC outlet in Washington, D. C., these special needs are met with a system incorporating Marlo multi-zone units, central station units, water coils and steam coils—28 pieces of equipment operating quietly and dependably.

Central station unit

In the complete Marlo line, you'll find equipment of the type and size to fit *your* air conditioning needs, too. Ask the Marlo representative in your area, or write to us for further information.

Marlo coil co.

SAINT LOUIS 11, MISSOURI

Quality Air Conditioning and Heat Transfer Equipment Since 1925

DURABLA REDUCING COUPLINGS NOW AVAILABLE FOR USE WITH *Basic-Check* UNITS

this combination is all you need to form a low cost, all stainless-steel check valve

Now, you can get DURABLA Reducing Couplings to match DURABLA ***Basic-Check*** Units. Supplied in line sizes from ⅜" to 2", they are recommended wherever a complete stainless steel (18-8) line check valve is required.

There has been no change in the ***Basic-Check*** Unit. It can still be used with almost *any standard pipe fitting* or, now, with a DURABLA Reducing Coupling. In either case, you have a complete check valve that will operate in any position – horizontally, vertically (with the inlet either up or down), and at any angle between. Suitable for almost any service – over a wide range of pressure-temperature ratings.

With a few of these units in stock you can meet practically any check valve emergency. For the full story, send for a copy of *new* 8-page bulletin HP49.

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114 Liberty Street, New York 6, N. Y.

Basic-Check Unit
(Pat. No. 2,649,277)

Reducing Coupling

Complete Check Valve

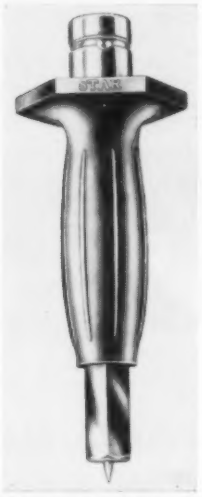
DURABLA

DM-31

EQUIPMENT DEVELOPMENTS

Continued

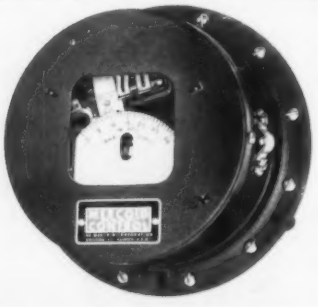
range of pumping requirements. The 5 and 7½ hp pumps available with 230 volt single-phase motors; all sizes are available with 3 phase motors for 220, 440, or 550 volt service.



Hand Operated Tool . . .

. . .for setting nail-type pins and threaded studs into masonry, concrete and concrete block—*Star Expansion Industries Corp., Dept. HPAC, Mountainville, N. Y.*

"Hamrdriver" setting, fastening tool requires no special attachments. Fixtures permanently, uniformly secured with threaded "Hamrstuds" or nail-type "Hamrpins," designed to penetrate up to ¼ in. low carbon steel.



Diaphragm Control . . .

. . .incorporating single diaphragm which actuates mechanism for opening, closing hermetically sealed mercury switch—*Mercoid Corp., Dept.*

For heating and air conditioning industries

...the big insulation news for 1959 is

JOHNS-MANVILLE FIBER GLASS

With L·O·F Glass Fibers Company joining the J-M family, your Johns-Manville representative can now serve you with J-M fiber glass insulation materials for these services:

Duct Liner—J-M Microtex® Coated Duct liner provides both acoustical and thermal insulation. Its fine glass fibers absorb mechanical noises . . . insulate against heat transfer . . . and its sprayed facing resists air erosion, even at top operating velocities.

Duct-Wrap—In J-M Microlite® and Super-Fine thermal insulations, millions of tiny glass fibers form countless dead-air cells to assure minimum heat transfer. Its light weight and handleability save installation costs, too.

Pipe Insulation—J-M Micro-LoK fiber glass insulation combines superior thermal performance with fast application. Micro-LoK is the only one-piece, full-length pipe insulation that offers "Spring-Hinge" action for easy opening and automatic closing.

All buyers of fiber glass products will now be served by an enlarged field staff of Johns-Manville sales and technical personnel operating out of 56 sales offices. This also means expanded distribution facilities . . . the addition of 7 strategically located plants . . . an expansion of research and development of fiber glass products.

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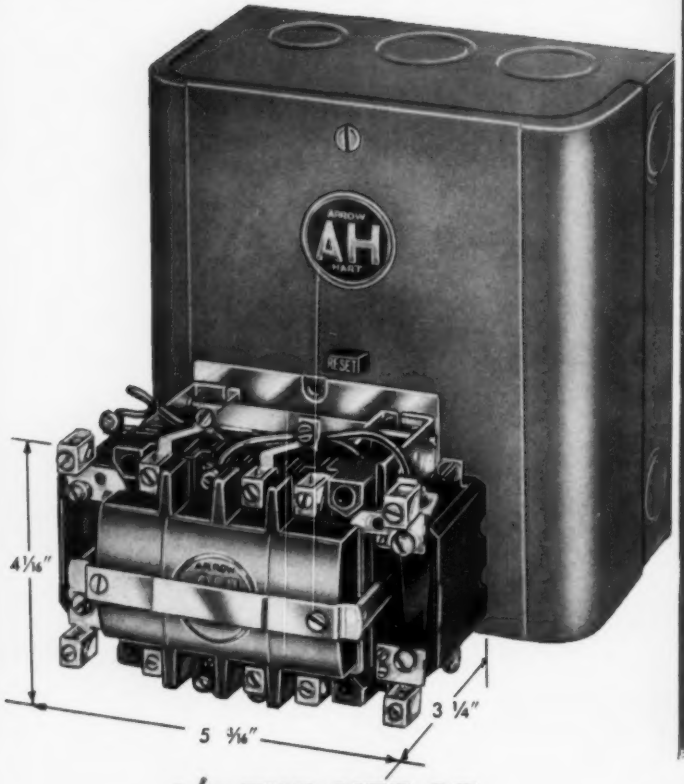
For further information, call your Johns-Manville representative or write to Johns-Manville, Box 14, New York 16, New York. In Canada, 565 Lakeshore Road East, Port Credit, Ontario.

JOHNS-MANVILLE

JOHNS MANVILLE JM PRODUCTS



1/2 THE SIZE OF CONVENTIONAL STARTERS

NEW MODEL 58 "RA" STARTERS

Featuring the exclusive Arrow-Hart "Right Angle" Mechanism, with the magnet operating through a simple bellcrank lever. The resulting mechanical advantage lets a smaller, lighter magnet outperform older, direct-acting types — makes it possible to cut starter size in half while improving performance. Easily placed in equipment cavities or on crowded panels, these compact starters help solve design problems and pack top performance into small space. Other important "RA" features include:

- **NEW WIDE VOLTAGE RANGE COILS** ... for Sizes 0, 1 and 2, with 1 coil now replacing 3 of the older type. STANDARD COIL VOLTAGES: 110-120, 208 230, 440-480, 550-600 VAC, at 60 cycles. New epoxy resin encased coils afford better protection against abuse and environmental conditions.
- **SIMPLE INSTALLATION AND MAINTENANCE** ... with straight-thru front wiring, easy contact accessibility, and new wrap-around enclosures for Size 1.
- **A COMPLETE LINE** ... including Sizes 0 through 5.

Write today for your free copy of Catalog 14: Arrow-Hart & Hegeman Electric Co., Dept. HPAC, 103 Hawthorn St., Hartford 6, Conn.

- **Have you seen Arrow-Hart's new 30 and 50 amp, 250 V, 4-wire grounding receptacles?**

ARROW AH HART

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MOTOR CONTROLS • ENCLOSED SWITCHES
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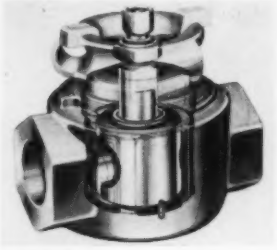
EQUIPMENT DEVELOPMENTS
Continued

HPAC, 4201 Belmont Ave., Chicago.

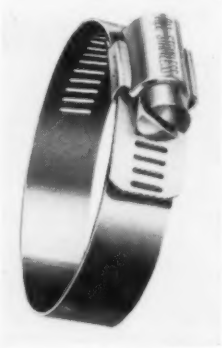
Diaphragm separates two pressure chambers, one for positive, the other for negative (vacuum) operation. Heavy gage steel flanged case has two 1/8 in. female pipe connections. Operating range: 1 to 30 in. water gage; maximum operating pressure: 20 psig. Fixed pressure differential of 0.6 in. WG when operating pointer is at low, 0.8 in. WG at medium and 1 in. WG at high. Available in fully automatic or semi-automatic types.



Plug Valve . . .

. . . tested up to 15,000 psi—*Hamer Valves, Inc., Dept. HPAC, P. O. Box 1851, Long Beach 1, Calif.*

New "Series D" plug valve said to require no adjustment, because of straight cylindrical seat design. Floating segment design said to prevent plug sticking. Valves designed to function between −40 and 250 F. Manufactured in 1, 2 in. sizes (7/8, 1 3/4 in. diam round openings).



Plastic Pipe Clamp . . .

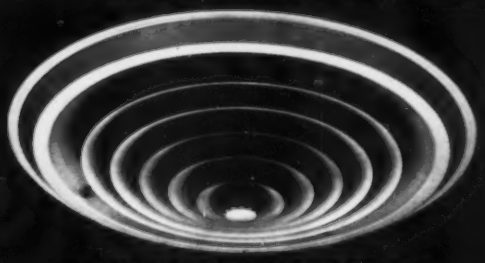
. . . developed for connecting lengths of rubber hose, plastic pipe, etc.—*Ideal Corp., Dept. HPAC, 435 Liberty Ave., Brooklyn 7.*

A Standard of Comparison of Airconditioning Registers and Grilles—The World Over

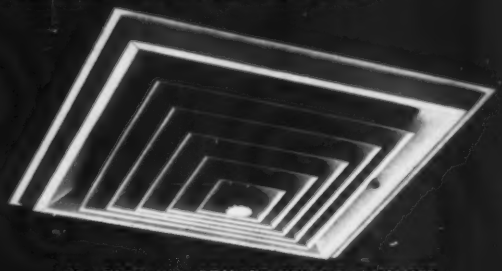
The HIGHEST QUALITY — The MOST COMPLETE LINES — From The Industry's FINEST Facility.

The No. 1500 ROUND CEILING DIFFUSER — **The No. 2500 SQUARE CEILING Diffuser**

REALLY "The BEST For LESS"—DESIGNED To COMPARE with Higher Priced LINES.



No. 1500 U.S. ROUND CEILING DIFFUSER



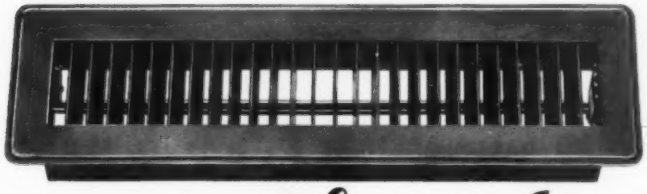
No. 2500 U.S. SQUARE CEILING DIFFUSER

Both No. 1500 Round and No. 2500 U.S. Square CEILING DIFFUSERS May be Equipped with the Smoothest and Most PERFECT Knob-Operated Bi-Valve Damper—An Original U.S. FEATURE.

U.S. OFFERS Your CHOICE of PERIMETER FLOOR DIFFUSERS

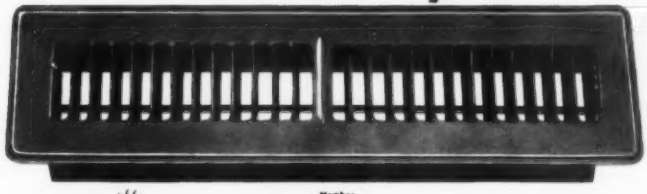
The NEWLY DESIGNED No. 410 U.S. DIFFUSER FLOOR REGISTER

FULL ONE INCH WIDE MARGINS to Cover Crackage left by Over Sized FLOOR OPENINGS. Heavy Gauge grille bars Curved to increase Air Deflection. Graduated Degrees of Air Flow. A Smooth Geared Lever Operation—with Set-Lock for Balancing the Job. SEAMLESS Smooth Corners — No Cracks or Breaks as in some Makes.



Perspective View of the Brand NEW LINE of No. 410 U.S. DIFFUSER Floor Registers. Super in STRENGTH—SUPREME in QUALITY—SUPERB in PERFORMANCE. SELECT The No. 410—The BEST in Floor Diffusers.

No. 413 StampAire FLOOR DIFFUSERS



DESIGNED For Projects on which PRICE PREDOMINATES

U.S. HAS IT—IF YOU MUST HAVE IT. A SUPER LOW COST FLOOR DIFFUSER that is superbly made but not to be COMPARED as EQUAL to OUR new No. 410 U.S. DIFFUSER FLOOR REGISTER. It is a Stamped-Face Register. The most perfectly constructed of its type. The Geared Lever actually and easily operates (compare it with others). The Set-Lock really functions.

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Minimize Liquid Handling Costs

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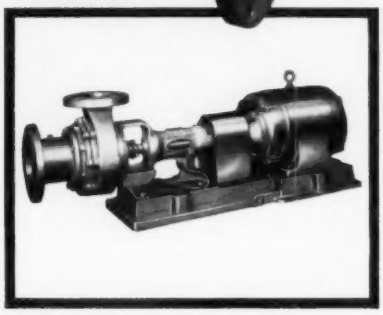
- SIMPLICITY OF DESIGN
- BALANCED IMPELLERS



Transfer, circulation, or pressure boosting of liquids—hot or cold—can be accomplished with the highest efficiency when you select AURORA End-Suction Centrifugal Pumps. Since less power is needed to provide required delivery, the initial cost is much lower and the operating cost less. Compactness and simplicity of design saves space and makes installation faster and easier.

Unique suction spool arrangement permits disassembly for maintenance without disturbing the discharge connection, pump-motor alignment or foundation bolts.

Vertical discharge makes pump self-venting, avoids vapor locks, and permits smooth running operation with a controlled noise level.

Typical applications include: condenser circulation, boiler feed, cooling towers, air conditioning systems, hot water circulation, and pressure boosters for water systems.

WRITE FOR BULLETIN 119-C

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EQUIPMENT DEVELOPMENTS
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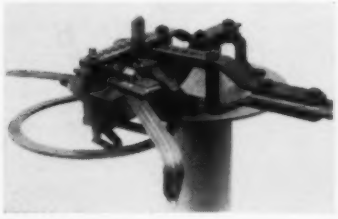
Stainless steel "Hy-Gear" worm drive clamp is non-collared and made in full range of sizes. Said to have holding power, corrosion resistance.



Pipe Bender . . .

. . . developed to perform bending operations including lambs' tongues, volutes, edgebends—*Hossfeld Mfg. Co., Dept. HPAC, 460 W. Third St., Winona, Minn.*

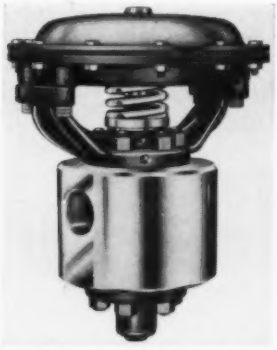
"Universal" pipe, bar, angle iron bender has handrail capping, scroll dies, making it versatile. Will also bend rounds, pipe, flats, tubing, squares, conduit, and angle iron. For hard-to-pull bends on heavier material, a hydraulic attachment is available.

Fuel Oil Filter . . .

. . . with built-in all purpose valve—*Shelton Co., Dept. HPAC, New Haven, Conn.*

Fuel oil filter valve said to eliminate, separate shutoff valve, several fittings. Utilizing cam lever principle, unit functions as filter, fire safety valve, manual shutoff valve, anti-syphon check valve, and anti-hum valve. Filtering efficiency provided through use of disposable cartridge. Constructed of heavy cast iron and steel with stain resistant enamel finish.

EQUIPMENT DEVELOPMENTS
Continued



Air Control Valves . . .

. . . designed for precise control of ultra-high pressure air on missile test stands, similar applications—*Sinclair-Collins Valve Co., Dept. HPAC,* 454 *Morgan Ave., Akron* 11, *Ohio.*

Screw-mounted, diaphragm-operated air control valves for pressures of 5000 psi have sleeve-type construction with aluminum bronze billet or alloy steel bodies. Replaceable hardened stainless steel seat sleeve insert in body said to maintain constant, precise alignment of valve stem and seats. Offered in two and three way types, NO or NC, in ½ and ¾ in. NPT sizes. Diaphragm operating pressure is 35 to 40 psi.

Adjustable Sheave . . .

. . . designed specifically to meet heating, ventilating, air conditioning requirements—*Allis-Chalmers Mfg. Co., Dept. HPAC,* 1171 *S. 70th St., Milwaukee* 1.

Features of "Adjustex" sheave cited by manufacturer include: economy, simplicity of adjustment; light weight; reduced overall length; reduced bearing loads; improved balance. Available for A, B, C section belts in 2, 3, and 4 groove construction. Design capacities to 75 hp covered by 33 sizes.

SAVES MORE SPACE THAN IT TAKES UP!...

DRUM MODULĀTIC
WATER-TUBE BOILERS
are SO COMPACT . . . SO EFFICIENT . . . they require only one-fourth the floor space of conventional boilers of comparable ratings!

SEE FOR YOURSELF!

Three Ways to Buy!

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3. Extended terms—up to 36 months after down payment.

Modulatics do much more than save space. They deliver 4 BHP per square foot of floor area . . . come completely assembled and wired . . . require no special foundation no forced-draft chimney . . . install in a few hours for fully automatic push-button operation. Features quiet 15-second guaranteed low fire "cotton-soft" start!

Output: 20 to 200 hp; 0-15, 5-150 psi steam pressure; 670,000 to 6,690,000 btu/hr . . . instant hot water; full pressure in five minutes from cold starts.

NEVER NEED REPLACEMENT

Modulatics accessible design permits quick, simple replacement of water-tubes (or other parts) for lifetime peak efficiency. Entire unit covered by 1-year materials and workmanship warranty and a 5-year tube warranty includes up to $50 labor allowance!

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Name_____
Company_____
Address_____
City, Zone, State_____

EQUIPMENT DEVELOPMENTS

Continued

Thermocouple Cable . . .

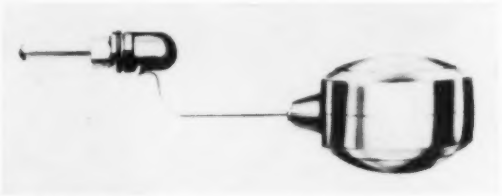
. . . developed to hold from 6 to 56 pairs of thermocouple conductors—*Thermo Electric Co., Inc., Dept. HPAC, Saddle Brook, N. J.*

Outer polyvinyl chloride jacket of "Thermo-Cable" resists moisture, abrasion, heat, chemical action. Can be installed in conduit, without conduit, in open troughs, or in raceways. "Thermo-Cable" made from either 20 or 16 gage solid wire, or in 17 gage stranded construction. All cables contain copper wire serving either as ground or communications wire. Available with either 6, 14, 18, 25, 39, 56 pairs of thermocouple conductors.

Flexible Oil Burner Hose . . .

. . . of flexible metal construction—*Techniflex Div., Dept. HPAC, 55 Jersey Ave., Port Jervis, N. Y.*

Seamless brass flexible hose developed to withstand pressures to 200 psi, remain unaffected by vacuum pressures. Supplied with ¼ in. male IPT thread to fit into oil burner and male flare fitting with flare nut to connect to copper tubing. Available in lengths from 10 to 18 in.



Float Valve . . .

. . . engineered for evaporative cooler, humidifier, industrial applications—*Robert Mfg. Co., Dept. HPAC, 9035 Venice Blvd., Los Angeles 34.*

"Bobby" float valve assembly has stainless steel seat; said to automatically maintain required liquid levels with positive shutoff. Capacity is 2½ gpm at 50 psi inlet pressure. Intended for use with ¼ in. tube or larger. "Red Bobby" unit designed for temperatures to 250 F.

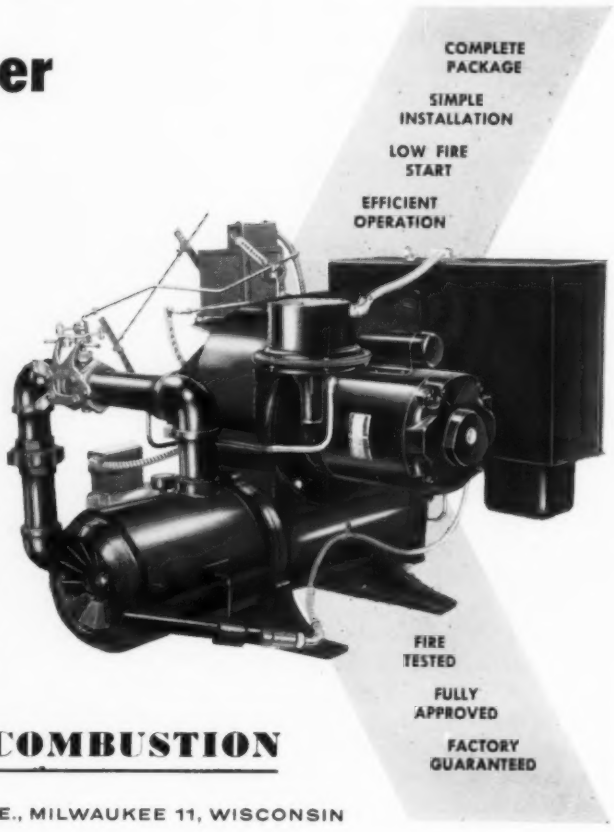
Gas Analyzer . . .

. . . for the detection of hazardous vapors—*Davis*

Low cost gas burner outstandingly efficient at all flame settings

Precision-engineered commercial-industrial Hev-E-Duty power gas burners are the low-cost answer to high heating efficiency with gas. Automatic electric ignition assures safe starting. Built-in low fire start that builds up slowly to the flame size required means smooth, safe operation. Minimum low fire and maximum high fire can be controlled exactly for top efficiency with any boiler or furnace.

Once set, the burner maintains this setting automatically regardless of weather. Sizes from 720,000 to 21,000,000 BTU. Hev-E-Oil and combination gas/oil models also available. For more information write Industrial Combustion, Inc., 4507 N. Oakland Ave., Milwaukee 11, Wis., Dept. HPA-4.



INDUSTRIAL COMBUSTION INC.

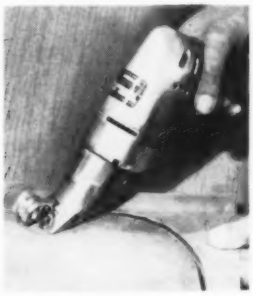
EXECUTIVE OFFICE: 4507 N. OAKLAND AVE., MILWAUKEE 11, WISCONSIN

EQUIPMENT DEVELOPMENTS

Continued

Emergency Equipment Co., Inc., Dept. HPAC, 55 Halleck St., Newark 4, N. J.

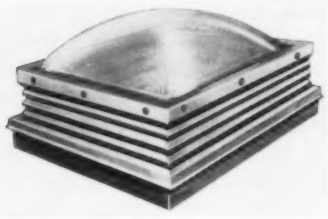
Portable gas analyzer is self-contained with long battery service life. Dial of analyzer has 2½ in. scale. Leather case holds aspirator bulb, 5 ft sampling hose, short probe, spare battery and screw driver. Spare filament also included. Analyzer unaffected by vapors of gasoline containing tetraethyl lead.



Sheet Metal Shear . . .

. . . designed to attach to industrial type ¼ in. drills—*C. W. Lind Co., Dept. HPAC, 4812 France Ave., N., Minneapolis* 22.

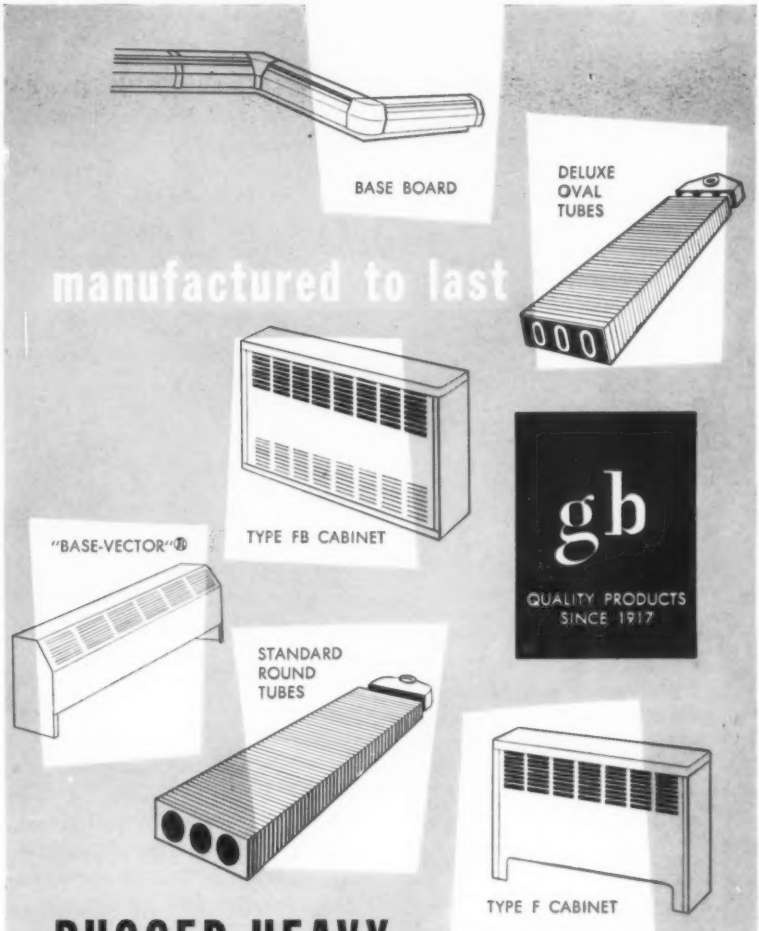
"Docken Shear" unit attaches to unit by removing drill chuck, replacing it with self-contained shear unit. Shearing blade, mounted between two cutting knives, gives cutting action of scissor through eccentric bearing arrangement on drill's drive assembly. Radial cuts on metal from 16 gage aluminum to 22 gage stainless steel possible without distorting material. Unit has 360 deg swivel for on the job cutting.



Penthouse Louvers . . .

. . . in design combining daylighting and ventilating in single unit—*E. Van Noorden Co., Dept. HPAC, 122 Magazine St., Boston* 19.

"Vanco Penthouse Louverdomes" designed for on-roof installations, re-



RUGGED HEAVY STEEL CONSTRUCTION

means proven efficiency, durability, practical quiet operation

The big difference in fin type heating units does not lie in efficiency alone, but in the heavy steel constructed units which hold the heat longer and are economical in fuel consumption.

Convectors made of steel give performance unequalled by light thin metals; take more abuse and withstand the severest handling on the job and subject to no loss of efficiency caused by mutilated fins.

Pioneers in the field of convector radiation, GOVERNALE BROS. Inc., have been manufacturing steel convector radiators for over a quarter of a century.

Engineers and builders have come to expect the finest quality convectors from GOVERNALE.

On your next heating job consult your local distributor or write, wire or telephone GOVERNALE for literature.

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Exclusive territories open to Authorized Distributors. Write for detailed information.

Install Insulation with

TUFF-BOND

Super-Strength Adhesives

TUFF-BOND #7
. . . fire-retardant adhesive for installing insulation

TUFF-BOND M-102-H
. . . economical duct liner adhesive

TUFF-BOND 21-C
. . . clear lap sealer and lap adhesive

TUFF-BOND 21-W
. . . white lap sealer and lap adhesive

TUFF-BOND #500
. . . exceptionally high-strength chemical-set adhesive with wide thermal range −100° F. to 400° F.

TUFF-BOND #1000
. . . high heat resistance for bedding and installing high temperature insulation

TUFF-BOND #12
. . . high pressure duct sealer

TUFF-BOND QUIK-SET
. . . neoprene-base, fast-setting adhesive. Recommended for installing metal and nylon hangers to smooth surfaces.

TUFF-BOND GENERAL PURPOSE
. . . all-around adhesive for installing insulation, insulation hangers, etc.

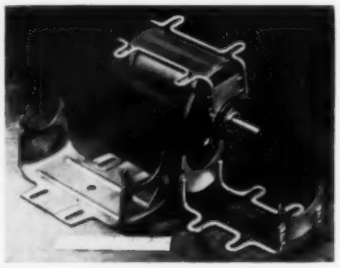
Ask for descriptive literature and prices.

GOODLOE E. MOORE
INCORPORATED
DANVILLE 26, ILLINOIS

EQUIPMENT DEVELOPMENTS

Continued

quiring overhead lighting and ventilation. Units consist of "Vanco Domelites," made of weather resistant, one piece, shatterproof plastic; and louvered penthouses of extruded aluminum. Available in square or rectangular shapes in wide range of sizes in height increments of 4 in.



Motor Mount . . .

. . . designed to permit reductions in shaft height—*E. H. Titchener & Co., Dept. HPAC, 67 Clinton St., Binghamton, N. Y.*

Light weight, resiliency, vibration dampening characteristics of twin-arm wire motor mount said to make it especially suitable to air conditioning applications. Open configuration allows unrestricted air circulation, reduces air turbulence. Mounts manufactured in conformity to NEMA specifications, can support motor vertically or horizontally. Dimensions, wire gage, bolt pattern can be modified to meet specifications.

Draft Control . . .

. . . developed for incinerator applications—*Wm. Steinen Mfg. Co., Heating Products Div., Dept. HPAC, 43 Bruen St., Newark 5, N. J.*

Incinerator draft control introduces unheated air into stack, reducing stack drafts to prevent sudden peaks in burning rates. Application features of unit cited by manufacturer include: prevention of high temperatures in incinerator and stack; reduction of fly-ash; increase in life of incinerator and stack; saving in clearance spaces.

Magnetic Controls . . .

. . . developed for air conditioning and heating applications—*Furnas Electric Co., Dept. HPAC, 1041 McKee St., Batavia, Ill.*

"Class 41" contactor line rated in 20, 30, 40 amp sizes for air conditioning and refrigeration; also rated at 10 hp, 220 volts; 15 hp, 550 volts polyphase for across-the-line control of electric motors. Rated for resistance heating loads through 40 amp. One-piece molded frame provides self-insulating base resistant to tracking, moisture. Solenoid assembly is silicon steel; movable contact assemblies have corrosion resistant stainless steel springs.

Solenoid Valve . . .

. . . in two-way design with 1/16 in. orifice (zero to 500 psi) to 3/16 in. orifice (zero to 70 psi)—*Airmatic Valve, Inc., Dept. HPAC, 7317 Associate Ave., Cleveland 9.*

Corrosionproof solenoid valve has one internal moving part and completely protected solenoid coil. Coil sealed from air, oil, gas, and water; coils for continuous or intermittent duty a-c or d-c are interchangeable. Adjustable flow control, manual override available. Unit can be either bottom drilled for manifolding or tapped for standard connection (⅛ or ¼ in. NPT).

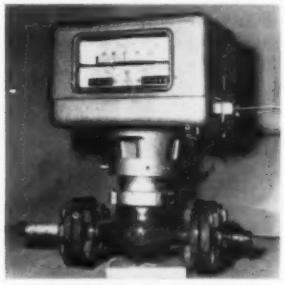
EQUIPMENT DEVELOPMENTS

Continued

Hammer . . .

. . . designed to absorb much of impact shock—*Ramset Fastening System, Olin Mathieson Chemical Corp., 12117 Berea Rd., Cleveland* 11.

Head of "Shure-Drive" hammer not rigidly connected to hammer handle, but suspended from it by elastic shock absorbers within head housing. Shock absorbers made of resilient material with energy-absorbing qualities, minimizing impact shock. Hammer weighs 2 lb.



Heat Pump Btu Meter . . .

. . . engineered to accurately measure heating and cooling consumption—*Air Conditioning Equipment Corp., Dept. HPAC, 219 E. 44th St., New York.*

"Pollux" Btu meter consists of liquid meter, integrator, two temperature sensing bulbs. One bulb placed in supply line, other in return line. Difference in water temperature between supply, return lines multiplied mechanically by integrator with flow of water which is converted to net weight. Result in Btu shown cumulatively on digital counter on meter.

Glass Fiber Paper . . .

. . . for air filtration—*Gelman Instrument Co., Dept. HPAC, 233 Jefferson,*

for pumping domestic and industrial wastes . . .

This Shone ejector has been in operation for 68 trouble-free years—in the Auditorium Hotel (Roosevelt College), Chicago, Illinois.

YEOMANS pneumatic ejectors cut service costs because

THERE'S NOTHING TO WEAR OUT

- NO ROTATING PUMP PARTS
- NO AIRTIGHT FLOATS
- NO HIGH-SPEED SHAFTS OR BEARINGS

With Yeomans pneumatic ejectors, maintenance costs are 50% to 75% lower than with the best centrifugal pumps. The secret? Simplicity of design. Yeomans pneumatic ejectors are built to give you decades of trouble-free service—in fact, they will outlast your system.

They're recommended for low gallonages. Even the smallest Yeomans ejector will pass solids up to the size of the inlet and discharge valves . . . minimum of four inches. No danger of clogging.

They're safer, and completely sanitary. Fully enclosed, hermetically sealed. Dangerous hydrogen sulphide gas is never released.

Yeomans manufactures both centrifugal pumps and pneumatic ejectors, but recommends the ejector where extreme dependability is required. Among the seven models and more than 100 sizes there is a pneumatic ejector that will exactly fill your needs.

Manufacturers of: pumps for drainage • sewage • condensation return • water supply and circulation • equipment for treatment of domestic and industrial wastes.

YEOMANS

YEOMANS, 2000-5 N. Ruby Street, Melrose Park, Illinois

Please send me literature on the pneumatic ejectors I have checked.

The Shone ☐

The Packex ☐

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important points about joints

- Yarway Gun-Pakt Joints are serviced *in the line under full steam pressure.*
- Costly shutdowns eliminated.
- Maintenance records show 1 manhour per year per joint.
- Fewer expansion joints needed per length of pipeline with Gun-Pakt.

YARWAY GUN-PAKT EXPANSION JOINTS

For new Yarway Expansion Joint Catalog EJ-1916 write YARNALL-WARING CO., 107 Mermaid Lane, Phila. 18, Pa.

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EQUIPMENT DEVELOPMENTS

Continued

Chelsea, Mich.

Glass fiber paper tested to filter at least 99.98 percent of test aerosol of 0.25 micron diam, according to manufacturer. Made of micro-fibers of glass. For dust, aerosol sampling glass fiber paper supplied in 1, 2, 3, 4 in. circles. Also available in sheets of various sizes. Can be used with temperatures up to 900 F to sample particles in process ducts, stacks.

Sealing Compound . . .

. . . for stopping spiral leaks from large diameter threads and coarse fittings, stop oval or distorted leaks in welded flanges—*Armite Laboratories, Dept. HPAC 6609 Broad St., Los Angeles* 1.

"No. 250 F" sealing compound with filler added said to be especially useful with cleanout plugs. Intended for applications with high temperatures —350 to 2987 F and pressures to 50,000 psi.

Equipment Briefs . . .

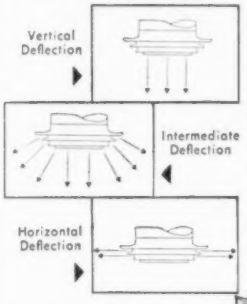
SULFITE DETERMINATION of boiler water with procedure which eliminates use of 50 percent acid and starch solution—*Betz Laboratories, Inc., Dept. HPAC, Gillingham and Worth Sts., Philadelphia* 24. By adding "Dry Sulfite Indicator" to water sample, concentration of sulfite may be determined from resultant color.

A-C, D-C ELECTRODE designed for joining and wear-surfacing austenitic manganese and carbon steels —*All-State Welding Alloys Co., Inc., Dept. HPAC, 249-55 Ferris Ave., White Plains, N. Y.* Low hydrogen nickel manganese electrodes yield alloy for hard surfaces and ductile welds. Yield strength 58,000 psi; tensile strength, 125,000 psi; elongation in 2 in., 50 percent; hardness as deposited, 18-22 Rockwell C; hardness after work hardening, 44-50 Rockwell C. Available in 1/8, 5/32, 3/16, 1/4 in. core sizes. ≠

Fresh air at working level improves employee efficiency

Barber-Colman industrial Venturi-Flo diffuser permits air to be introduced at the worker's level—duct work can be extended to provide a 10′ mounting height. This prevents stagnant, smoky air, which has collected near the roof, from being mixed with the incoming fresh air. Employee comfort and efficiency are improved considerably.

The Venturi-Flo industrial diffuser can be adjusted easily from the floor to deliver any air pattern. In warm weather, the air should be delivered close to, or even directly at, the worker; while during cool evenings, or



in cold weather, the air should be diffused above the head of the worker, providing ventilation without drafts.

A complete range of sizes available to meet any industrial requirement. Ask for Bulletin F-7722-1. Call your Barber-Colman Field Office or write:

BARBER COLMAN

BARBER-COLMAN COMPANY

Dept. P, 1101 Rock Street, Rockford, Illinois

RECENT TRADE LITERATURE...

▸ *A-C MAGNETIC STARTERS*—New 15 page booklet "EN-150" describes company's line of "Three Star" magnetic starters, available in NEMA sizes zero through 4 for both reversing and non-reversing single-phase and squirrel cage motors. Detailed description of line's component units, elements included with description of individual starters (including ratings, dimensions). *Cutler-Hammer Inc., Dept. HPAC,* 421 *N.* 12*th St., Milwaukee* 1.

▸ *ADHESIVES, COATINGS*—New 12 page illustrated catalog describes design concepts, typical applications, general characteristics of adhesives, coatings, sealers available from manufacturer. Text is illustrated throughout with diagrams, photos. *Minnesota Mining & Mfg. Co., Adhesives, Coatings & Sealers Div., Dept. HPAC,* 900 *Bush Ave., St. Paul* 6, *Minn.*

▸ *AIR CONDITIONING UNITS*—Bulletin contains complete information on induction circulators for high pressure induction air conditioning systems. Line available in three models: "Slimline"; "Lowline"; "Ceiling Mounted." New 28 page publication explains operation of system in text, graphs, charts. *Worthington Corp., Dept. HPAC, Harrison, N. J.*

▸ *AIR DUCT*—New, illustrated 4 page brochure gives features, applications, dimensions of manufacturer's asbestos-cement air ducts for heating, air conditioning, ventilating installations. *Keasbey & Mattison Co., Dept. HPAC, Butler Ave., Ambler, Pa.*

▸ *AIR HANDLING UNITS*—Recent papers on air handling unit phase of high velocity air conditioning systems by C. W. Pollock, manager of company's air conditioning and refrigeration, available now in reprints, as "HCD, Reprint No. 1." Text compares factors, presents eight point analysis on mounting motors. Photos of zoned unit installation and hot and cold deck high pressure air handling unit illustrate text. *Drayer-Hanson, Div. of National-U. S. Radiator Corp., Dept. HPAC,* 3301 *Medford St., Los Angeles* 63.

▸ *ALUMINUM FOR HEAT EXCHANGERS*—Advantages of use of aluminum in heat exchanger fabrication described in new publication. In 16 pages of charts, pictures technical information needed by heating engineer, fabricator, industrial purchasor is summarized. Text covers aluminum heat transfer rates, temperature properties, tensile strengths, pressures and dimensional tolerances. *Reynolds Metals Co., Dept. HPAC, Box* 2346, *Richmond, Va.*

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"Perimeter" REGISTERS

For Baseboard Heating or Cooling

STYLE NO. 40

Two-piece design, solid back frame that does not require a stack head. The circulating air is evenly distributed in a fan-shaped pattern, so that it moves out and up closely paralleling the wall surface. Three sizes — for 2¼" x 10", 2¼" x 12" and 2¼" x 14" openings. Overall size 18½" x 4½". Base extension 3⅛". Open area 23 sq. inches. Furnished in prime coat or Fabritone finish.

STYLE NO. 60-A

For Floor Installations

The grille faces of these registers for floor installation are the famous "Fabrikated" construction, excelling in rigidity, open area and attractive appearance. Face bars made of solid steel bands #14 ga. x ½" deep, mill edges. Bars individually adjustable if desired. An adjusting screw allows air flow to be directed toward outer wall when valves are set in the correct position.

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THE INDEPENDENT REGISTER CO.

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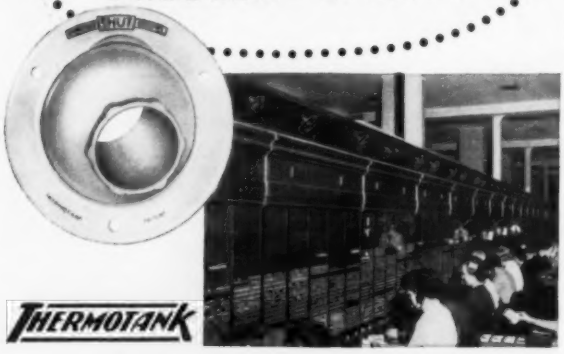
FOR ANY DIFFICULT
SPOT COOLING OR HEATING
PROBLEM—SPECIFY



round type punkah louvres

More than thirty years ago THERMOTANK engineers designed, developed and installed round punkah louvres (the original jet air outlet) in ships sailing to the Far East. Since its original application in ships, the effectiveness of THERMOTANK punkah louvres has been widely used on an ever increasing variety of applications.

HERE ARE SOME REASONS WHY:

1. Finger-tip adjustment projects air stream in any desired location.
2. Provides the most effective throw for its size and pressure.
3. Ideally used for air distribution in remote areas where branch ducts cannot be accommodated.
4. Draftless, quiet operation . . . easy to balance.

THERMOTANK round type punkah louvres are recommended for any cooling, heating or ventilating requirement. For complete engineering data on round punkah louvres, ask for catalog TA-150.

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high velocity units • punkah louvres
air diffusers • filters • exhausters
registers and grilles

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185 MADISON AVENUE, New York 16, N. Y.

RECENT TRADE LITERATURE

Continued

▸ *AUTOMATIC AIR FILTER*—Construction, operating features of new "Model B Roll-O-Matic" automatic renewable media air filter presented in bulletin "No. 248-C." Unit features 65 ft roll of impregnated, reinforced media composed of continuous, slightly curled, interlaced glass filaments held in place by plastic bond to form pad or blanket of 2 in. Media will not drip at temperatures to 150 F; will not lose adhesion due to dryness. *American Air Filter Co., Inc., Dept. HPAC,* 215 *Central Ave., Louisville* 8, *Ky.*

▸ *BLOW-OFF VALVES*—"Yarway Unit Tandem Blow-Off Valves" for boiler blow-off pressures to 665 psi, basic pressure rating 400 psi described in new bulletin "B-435, Supplement A." Publication contains full description, operating details, materials, dimensions, advantages. *Yarnall-Waring Co., Dept. HPAC,* 107 *Mermaid Ave., Philadelphia* 18.

▸ *BOILERS, RADIATION, CONDENSERS*—New 4 page brochure presents company's complete line of "Box-Fin" baseboard radiation, industrial and commercial radiation, motorized zone control valves, coaxial refrigerant condensers, "Zone-A-Matic" packaged heating units, basic boilers and water heaters, "Airvec" refrigerant condensers, finned tubing. *Edwards Engineering Corp., Dept. HPAC,* 101 *Alexander Ave., Pompton Plains, N. J.*

▸ *CENTRIFUGAL COMPRESSORS*—New 12 page bulletin contains information about compressor, motor, guide vanes, impellers and lubrication system of company's "Hermetic Centrifugal" unit. Bulletin illustrated with graphs, pictures. Also contains chart illustrating various condenser and cooler water nozzle arrangements possible with two and three pass coolers and condensers. *Worthington Corp., Dept. HPAC, Harrison, N. J.*

▸ *CIRCULAR SLIDE RULE*—Pocket size calculator offered for performance of simple multiplication, division, proportional calculations. Requests for the circular slide rule are to be made on business letterhead paper. *General Industrial Co., Dept. HPAC,* 5738 *Elston Ave., Chicago* 30.

▸ *COOLING TOWERS*—Four page "Bulletin No. 55-902" gives features, complete details on company's "Series V" cooling towers. Engineering data, general dimensions given in table form. Capacity table also included. "Bulletin 56-902" describes natural draft towers of steel and redwood or all steel construction. Full specifications, engineering data, capacities also given. *J. F. Pritchard & Co. of California, Dept. HPAC,* 4625 *Roanoke Pkwy., Kansas City* 12, *Mo.*

RECENT TRADE LITERATURE

Continued

▸ *COOLING TOWER COATING SYSTEM*—"Bulletin 1650" outlines company's system of metal protection for atmospheric heat transfer equipment. Specifications, application information on system included in publication. *Dampney Co., Dept. HPAC,* 50 *Business St., Hyde Park, Boston.*

▸ *COUPLINGS*—Illustrated 20 page catalog describes extensive line of "Quick-Seal" couplings for hydraulic and pneumatic applications. New bulletin "No. Q. S. R. 58" discusses three types of couplings: straight-through; single check valve; double check valve. Couplings avilable in variety of sizes, alloys to meet operating requirements. Designed to handle chemicals, oils, greases, gases, liquids. *Titeflex, Inc., Dept. HPAC, Hendee St., Springfield* 1, *Mass.*

▸ *COPPER TUBING*—"Copper & Copper Alloy Metalexicon" provides guide through complex terminology applied to brass mill products. New 24 page booklet supplies definitions for such terms as: "deoxidized"; "flat wire"; "patent leveling"; season cracking"; many others. *American Brass Co., Dept. HPAC,* 414 *Meadow St., Waterbury* 20, *Conn.*

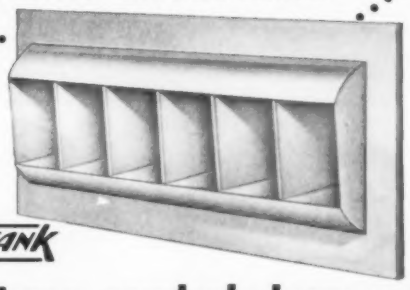
▸ *DEHUMIDIFIERS*—Bulletin "MD-4" presents line of mechanical dehumidifiers using refrigerant No. 12 and 22 compressors from 5 to 60 hp to a dewpoint of 36F. Unit capacities are from 640 to 11,856 cfm; with 32,032 grains to 1,591,968 grains of moisture removed per hr. *M. Blazer & Son, Dept. HPAC,* 173 *Market St., Passaic, N. J.*

▸ *DIAL THERMOMETERS*—Illustrated 12 page catalog "No. 205" describes redesigned line of indicating dial thermometers for measurements in range of −40 to 1000 F. Catalog gives specifications for both direct and remote reading types, gives information on four types of filling mediums, as well as thermometer case sizes, materials, styles. *U. S. Gauge, Div. of American Machine and Metals, Inc., Dept. HPAC, Sellersville, Pa.*

▸ *DUST COLLECTOR*—"Industry Relies on Dustube Collectors for Efficient Dust and Fume Control" is title of 24 page illustrated application handbook describing range of dust, fume producing processes that can be controlled with cloth or glass bag type dust collectors. *Wheelabrator Corp., Dept. HPAC,* 1321 *S. Byrkit St., Mishawaka, Ind.*

▸ *ELECTRODES*—Welding shop wall chart of 89 specialty alloys, fluxes available from manufacturer.

FOR EXTREMELY LONG THROWS OF AIR IN LARGE AREAS OF ANY ENCLOSURE



THERMOTANK

drum type punkah louvres

Drum type punkah louvres originated by THERMOTANK engineers combine design and performance features that make them ideally suited for installation in large enclosures where extremely long throws are required.

THERMOTANK drum type punkah louvres are engineered to provide both horizontal and vertical control of the air stream. In addition, control of length of throw and its location is made possible by the rotating drum feature and adjustable vane design.

THERMOTANK drum type punkah louvres can be mounted in either a horizontal or vertical position without affecting the distribution of air from the outlet. This feature offers the architect and engineer unlimited application possibilities and does not restrict the location of the punkah louvres.

THERMOTANK drum type punkah louvres are highly recommended for installation in missile manufacturing plants, automobile assembly plants, aircraft plants, airport terminals, gymnasiums, arenas, in fact, any large enclosed area where air movement must be correctly distributed.

For complete engineering data on these punkah louvres, ask for catalog TA-150.

THERMOTANK AGITAIR

high velocity units • punkah louvres
air diffusers • filters • exhausters
registers and grilles

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Heating and Air Conditioning

PRESSURE MEASUREMENT

ASHCROFT GAUGES DO THE JOB *ACCURATELY*

Ashcroft Duragauge in Phenol Case

Name the operational pressures of any heating, piping or air conditioning equipment you specify, install or service: There's an Ashcroft Gauge to measure the pressures precisely—from 30″ vacuum or a few ounces to the highest psi used on any system. That is why Ashcroft Gauges are used on everything from giant boilers to small compressors.

You have a choice of three classes of Ashcroft Gauges. Each class has functional characteristics compatible with its recommended applications.

DURAGAUGES: The finest pressure gauges you can specify and install on any heating, piping or air conditioning system. Highest sustained accuracy and durability assure savings in replacements and repairs far exceeding the initial investment.

QUALITY GAUGES: Second only to the Duragauge in ruggedness and sustained accuracy. Ideal for the normal industrial, commercial and institutional equipment.

STAINLESS STEEL CASE GAUGES: The best gauges for small compressors, pumps, boilers and the less important pressure lines. Inexpensive but accurate and durable.

Whatever the medium under pressure—air, oil, water, steam, or refrigerant—select Ashcroft Gauges. Pressure, vacuum and compound ranges available. Several dial sizes. *Write for Catalog 300B.*

Ashcroft Quality Gauge in Alumalife® Case. Catalog No. 1010.

Ashcroft Gauge in Stainless Steel Case. Catalog No. 1000.

ASHCROFT PRESSURE GAUGES

A product of

MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Stratford, Connecticut
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

RECENT TRADE LITERATURE

Continued

Recommendations made on 18 × 22 in. wall chart are specific to company's alloys, fluxes. *All-State Welding Alloys Co., Inc., Dept. HPAC, White Plains, N. Y.*

▸ *ELECTRODES*—Technical data sheet provides information on "Jetweld LH-90" and "LH-110." Operating characteristics, physical properties, markings and current ranges given in chart form. *Lincoln Electric Co., Dept. HPAC,* 22801 *St. Clair Ave., Cleveland* 17.

▸ *FLAME SAFEGUARD*—Features of new "R4075A Protectoglo" flame safeguard units presented in "Specification S1015-5." Illustrated sheet covers construction, operation, applications of new unit in detail. *Minneapolis-Honeywell Regulator Co., Industrial Div., Dept. HPAC, Wayne and Windrim Aves., Philadelphia* 18.

▸ *FUEL OIL HEATERS*—New 8 page bulletin gives complete specifications, description of manufacturer's fuel oil heaters used on suction side of pumps for heating extremely viscous fluids. Two principal types catalogued are: tank suction type heater; line type heater. *Brown Fintube Co., Dept. HPAC,* 502 *Huron St., Elyria, Ohio.*

▸ *GAS REGULATORS*—New 36 page catalog "Form ADC 705F" covers manufacturer's complete line of cylinder, manifold, station pressure regulators. Illustrated publication contains flow, pressure specifications, as well as inlet and outlet connection dimensions for each regulator. Adapters, station valves, flowmeters, hose connections, pressure gages also described in detail. *Air Reduction Sales Co., Div. of Air Reduction Co., Inc., Dept. HPAC,* 150 *E.* 42*nd St., New York* 17.

▸ *GEARMOTOR*—Recently published 4 page bulletin "No. 3050" offers engineering information on gearmotor ratings of 1/3 to 30 hp, single reduction with output speeds of 23 to 280 rpm. Cutaway view of gearmotor included in bulletin. Engineering specifications also given. *Louis Allis Co., Dept. HPAC,* 427 *E. Stewart St., Milwaukee* 1.

▸ *HOSE*—New 8 page illustrated bulletin, "Condensed Catalog No. 34" contains information on wide variety of "Le-Hi" couplings and fittings for every type of industrial rubber hose. Also includes description, illustrations of new items added to line. *Hose Accessories Co., Dept. HPAC,* 2704 *N.* 17*th St., Philadelphia* 32.

▸ *HOT WATER HEATING COILS*—New bulletin describes line of hot water heating coils produced in wide

RECENT TRADE LITERATURE

Continued

range of sizes for central station or zone air conditioning systems. Publication "HWG-200" provides complete dimensional data on company's hot water coils, also contains charts with rating data for selection of proper coils for most applications. *Halstead & Mitchell, Dept. HPAC, Bessemer Bldg., Pittsburgh* 22.

▶ *INSTANTANEOUS HEATERS*—Illustrated bulletin "304.4K1" presents company's new instantaneous heaters with extra large steam inlet area. New 23 page publication contains 17 pages of selection tables, charts, piping diagrams to help in selection of proper units to meet various requirements. *American-Standard, Industrial Div., Dept. HPAC, Detroit* 32.

▶ *MASONRY ANCHORS*—New, comprehensive brochure details company's line of compounded "Slugin" masonry anchors for heavy duty fastenings to masonry and concrete construction with standard machine bolts. Publication gives description, technical data on tensile shear and compression strengths: includes photo illustrations, cross section drawings, full specifications on all sizes. *Star Expansion Industries Corp., Dept. HPAC, Mountainville, N. Y.*

▶ *MERCURY PLUNGER RELAYS*—Recently revised fact file gives load ratings, contact data, coil characteristics, mounting dimensions, diagrams, illustrations, technical articles on application engineering of mercury plunger relays. *Ebert Electronics Corp., Dept. HPAC,* 212-31*R Jamaica Ave., Queens Village* 28, *N. Y.*

▶ *MOTOR REPAIR*—New 4 page bulletin gives explanation of how company's repair and replacement service program works, provides list of authorized service stations. *Century Electric Co., Dept. HPAC,* 1806 *Pine St., St. Louis* 3.

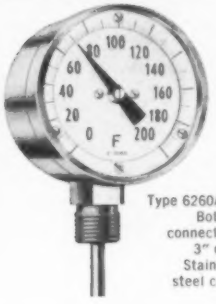
▶ *MOTORS, PUMPS*—New, 20 page booklet describes company's line of motors, pumps for wide range of commercial, industrial applications. Installation photos illustrate suggested applications. *Allis-Chalmers Mfg. Co., Dept. HPAC, Box* 512, *Milwaukee* 1.

▶ *MULTIZONE CONDITIONERS*—Description, performance data, specifications, dimensions of manufacturer's multizone air conditioners included in new publication, "Catalog No. 383A." Units range in size from 4060 to 19,200 cfm to provide heating, cooling, ventilating, filtering, humidifying, dehumidifying of air for up to 16 zones. *Acme Industries, Inc., Dept. HPAC,* 600 *N. Mechanic St., Jackson, Mich.*

Heating and Air Conditioning

TEMPERATURE MEASUREMENT

AMERICAN THERMOMETERS DO THE JOB ACCURATELY



Type 6260AH—Bottom connection. 3" dial. Stainless steel case.

They respond quickly and accurately to all temperature changes, whether mounted on a blower in a basement or on air conditioning equipment on a roof. American Bi-Metal Dial Thermometers combine superior resistance to vibration with the greatest sensitivity in bi-metal actuation. Two other advantages provide extra value:

ANTI-PARALLAX MAXIVISION® DIAL guarantees surest, sharpest, easiest readings. It is a split-level dial constructed with graduations and pointer on the same plane. No perspective effect. No parallax error in reading. Only American Thermometers have this feature.

WEATHERPROOF CONSTRUCTION seals out all atmospheric and application conditions that might cause erosion, corrosion, inaccuracy and shorten service life.

Wherever accurate temperature measurements are essential—whatever the operational temperatures of the heating or air conditioning system — choose American Thermometers. Mounting styles include the "Every Angle" thermometer you can set for face-to-face readings wherever installed. Dial sizes, temperature ranges and stem lengths to meet your needs exactly. *Write for Catalog 100.*

Type 6360AH — Back connection. 3" and 5" dials. Stainless steel case.

Type 6060AH—"Every Angle" connection permits setting at any point within 180° on two axes. 5" dial. Stainless steel case.

Type 6360AH — Back connection. 2" dial permits installation in close quarters without sacrificing readability. Stainless steel case.

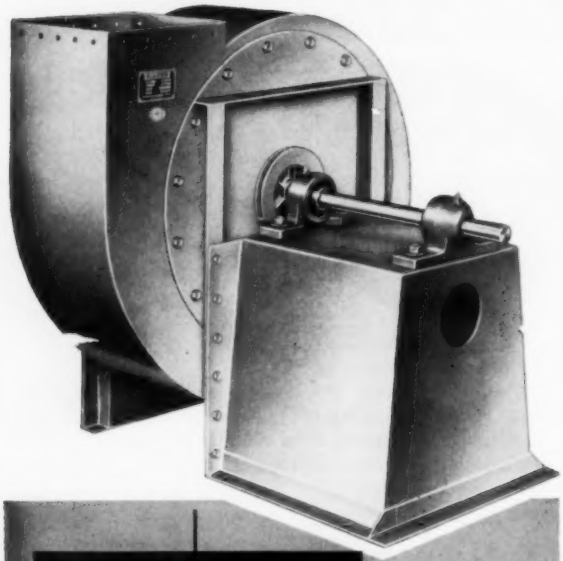
AMERICAN THERMOMETERS

A product of

MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Stratford, Connecticut
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

Aladdin
AIR HANDLING EQUIPMENT



TYPE
"EX"
INDUSTRIAL
EXHAUSTER

- RUGGED
- EFFICIENT
- DEPENDABLE

ALADDIN Industrial Exhaust Fans are all-welded steel plate-construction. They are ideal for material handling such as conveying grains, shavings and sawdust, or for dust removal from grinding of buffing wheels. The EX fan is also the first choice for many jobs where fumes, hot air or gasses must be handled by a rugged, efficient, dependable fan.

Write for complete data

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 · SAN LEANDRO, CALIFORNIA

RECENT TRADE LITERATURE

Continued

▸ *PACKAGED BOILER*—Illustrated 4 page brochure, "Bulletin 200," provides description operational and design details, specifications on manufacturer's "No. 200 Series" packaged boilers. Brochure is illustrated throughout with photos, detail drawings. *Johnston Brothers, Inc., Dept. HPAC, Ferrysburg, Mich.*

▸ *PACKAGED WATER CHILLERS*—Illustrated 16 page brochure, "Bulletin 8325," describes redesigned line of "Type CD" packaged water chillers for air conditioning and industrial cooling applications. Schematic wiring diagrams, illustrations of pneumatic control connections, selection charts, installation type drawings all included. *American-Standard, Industrial Div., Dept. HPAC, Detroit* 32.

▸ *PIPE LINE FILTERS*—Information on company's new industrial pipe line filters given in 4 page bulletin. Data given in text, photographs, charts. Though designed primarily for filtration of corrosive fluids, filters also intended for flow control, gas diffusion, purification. *Corning Glass Works, New Products Div., Dept. HPAC, Corning, N. Y.*

▸ *PLASTIC WELDER*—High speed hand welders for thermoplastics pictured, described in new 4 page bulletin. Information on welding speeds, strengths and characteristics of construction included. *Laramy Products Co., Dept. HPAC,* 90 *South St., Hingham, Mass.*

▸ *REDUCING VALVE*—Catalog sheet describes company's "Fig. 1910 Type E" reducing valve for initial pressures to 300 psi with gas, oil or water. Outlet or regulated spring ranges are 5-35, 20-60 and 40-90 psi. Sheet includes features, description, operating and ordering information, valve drawing and photo, dimensions, parts list. *Atlas Valve Co., Dept. HPAC,* 280 *South St., Newark* 5, *N. J.*

▸ *REGISTERS, DIFFUSERS*—Engineering data on heating and cooling systems intended to help in selection, sizing of diffusers, registers, grilles is contained in new catalog. Engineering section provides installation facts, figures—includes sizing, performance charts, plus Btu per cfm conversion table. *Lima Register Co., Dept. HPAC,* 1790 *Cable Rd., Lima, Ohio.*

▸ *ROOF VENTILATORS*—New 8 page illustrated brochure gives information on construction features, capacities, quietness, accessories of manufacturer's new line of centrifugal type roof ventilators. Design, con-

RECENT TRADE LITERATURE

Continued

struction features of 13 basic ventilator sizes including 111 different motor and belt-drive combinations listed for various building environments. *American-Standard, American Blower Div., Dept. HPAC, Detroit* 32.

▸ *SEALING MATERIAL*—"Wat-R-Bar," new sealing material said to offer new high in freeze-thaw resistance is subject of literature available from manufacturer. Bulletin describes controlled laboratory tests of product, chemical characteristics, applications. *Presstite-Keystone Engineering Products Co., Dept. HPAC, 39th and Chouteau, St. Louis.*

▸ *SILICONES*—Company's 1959 reference guide to its silicone products intended to solve application problems. New 16 page publication guide is illustrated, has expanded indexing system for over 150 of company's silicone products available. *Dow Corning Corp., Dept. HPAC, Midland, Mich.*

▸ *SPREADER STOKES*—Detailed information on company's "Series 401" pneumatic spreader coal stokers given in new 12 page booklet "2530." Publication illustrated with cutaway views, installation photographs, diagrams. *Iron Fireman Mfg. Co., Dept. HPAC, 3170 W. 106th St., Cleveland* 11.

▸ *STAINLESS STEEL PRODUCTS*—Complete 159 page reference manual, entitled, "Buyers' Guide for Stainless Steel Products and Service," contains 188 specific and general stainless steel product categories with manufacturers' names and locations. Table gives names, addresses of mill suppliers and mill forms and shapes they produce. *Committee of Stainless Steel Producers, American Iron and Steel Institute, Dept. HPAC, 150 E. 42nd St., New York* 17.

▸ *STAINLESS STEEL VALVES*—Complete line of company's stainless steel gate, globe and swing check valves is presented in new catalog, "No. 59 SS." Catalog also has 10 page section showing degree of resistance of company's alloys to corrosive media under varying conditions. *Jenkins Bros., Dept. HPAC, Room 133, 100 Park Ave., New York* 17.

▸ *STAINLESS VALVES*—Technical bulletin "No. 8" describes "Aloyco 20," special austenitic stainless steel recommended for valving sulfuric acid, other severely corrosive liquids. Bulletin includes cross-sectional views, graph. *Alloy Steel Products Co., Inc., Dept. HPAC, 1322 Elizabeth Ave., Linden, N. J.*

PROBLEM:

Cooling towers—find a nozzle that delivers large droplets at low pressure

SOLUTION:

Delavan Types WR or WC nozzles

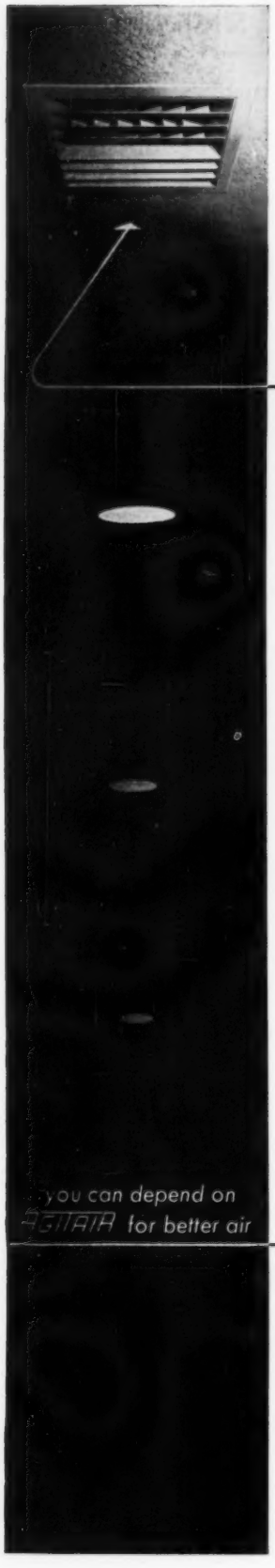
Both these Delavan nozzles operate effectively at pressures as low as 2 psi. Produce large droplets with minimum drift-age. Clogging is held to a minimum. There are no vanes, cores or other obstruction to promote corrosion build-up. WR and WC deliver uniformly distributed, hollow cone patterns for maximum heat transfer. They're accurately calibrated to the capacity and spray angle you request. A wide range of capacities, pipe sizes and materials is available.

If the right nozzle will improve your air conditioning equipment, there's a Delavan nozzle that will do it better. Write for Catalog 33A today.

DELAVAN *Manufacturing Company*

WEST DES MOINES, IOWA

WORLD'S LARGEST NOZZLE SPECIALIST


Custom Made
AIR DIFFUSERS
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DIFFUSING VANES
Each AGITAIR square and rectangular air diffuser is custom designed to meet your requirements of air flow and interior treatment.
These AGITAIR diffusers have built-in diffusing vanes, scientifically arranged in unlimited louver patterns to provide certified 100% draftless air distribution from any ceiling or wall location.
AGITAIR Catalog R-107 shows you how to select the proper size and pattern for your job conditions.
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you can depend on AGITAIR for better air
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185 MADISON AVE., N. Y. 16, N. Y.
air diffusers • filters • exhausters

RECENT TRADE LITERATURE

Continued

▸ *STOKER FIRING CHART*—Boiler room wall chart gives operating instructions, efficiency instructions for underfeed stokers. Complete text, drawings present information intended to raise stoker firing to high level of efficiency. *Bituminous Coal Institute, Dept. HPAC, Southern Bldg., Washington 5, D. C.*

▸ *SUMP PUMP*—Bulletin "SS 800" describes manufacturer's "Model SS 805" sump pump with hermetically sealed 1/3 hp capacitor type motor. Publication includes installation diagrams. *Weil Pump Co., Dept. HPAC, 1530 N. Fremont St., Chicago 22.*

▸ *SURGE RELIEF VALVE*—Method of protecting water lines against overpressures in system with surge relief valve described in bulletin "W-2-A." New 8 page publication gives complete engineering information, detailed drawings, suggested specifications. *Golden Anderson Valve Specialty Co., Dept. HPAC, 1210 Ridge Ave., Pittsburgh 33.*

▸ *TEMPERATURE CONTROLLERS*—"Specification S1010-6" gives details on "Versa-Tran" electronic temperature controllers for industrial heating and cooling operations. *Minneapolis-Honeywell Regulator Co., Industrial Div., Dept. HPAC, Wayne and Windrim Aves., Philadelphia 44.*

▸ *TEXTILE AIR CONDITIONING*—New brochure, "Bulletin H75," presents method of spinning frame and room cleaning by company's "Type CTG" traveling cleaners for textile mills. Design, operation, maintenance covered in bulletin's illustrations, text. *Parks-Cramer Co., Dept. HPAC, P. O. Box 444, Fitchburg, Mass.*

▸ *VACUUM CLEANING SYSTEMS*—"Catalog No. 160" is 8 page, illustrated brochure presenting manufacturer's permanent installed vacuum cleaning systems for institutions, civic and commercial buildings. Catalog is well illustrated with photos, drawings, diagrams. *Spencer Turbine Co., Dept. HPAC, 486 New Park Ave., Hartford 6, Conn.*

▸ *WALL EXHAUSTERS*—New line of centrifugal wall exhausters providing maximum discharge for 360 deg diffusion described in special catalog sheets. Of heavy gage aluminum construction, exhausters said to be extremely quiet, have high capacity air movement. Literature illustrated with photographs; details, specifications also included. *Power Line Fan Co., 639 South Ave., Dept. HPAC, Plainfield, N. J.* ±

WHO'S WHAT . . .

(new personnel, promotions)

▸ *HUPP CORP.*—John O. Ekblom, chairman of board of directors.

▸ *WHEEL TRUEING TOOL CO.*—H. E. Robinson, president and treasurer; H. B. Wallace, chairman of board of directors.

▸ *REYNOLDS METALS CO.*—William G. Reynolds, and Joseph H. McConnell, elected executive vice presidents.

▸ *OHIO BRASS CO.*—Joseph T. Lusignan, vice president, engineering; Louis J. Ott, vice president and general manager of sales; Estes C. Thompson, vice president, manufacturing; J. Howard Holan, vice president.

▸ *ALLIS-CHALMERS MFG. CO.*—Joel Hunter, president of the Crucible Steel Co. of America, Pittsburgh, elected to board of directors; Beauchamp E. Smith, general manager of hydraulic division, elected vice president.

▸ *OSTER MFG. CO.*—Robert C. Baumgartner, elected to board of directors.

▸ *UNIVERSITY OF ROCHESTER, COLLEGE OF ENGINEERING*—Dr. John W. Graham, Jr., dean.

▸ *SQUARE D CO.*—Edmund V. Dowden, works manager of Electric Controller & Manufacturing Div.

▸ *ROBERTSHAW-FULTON CONTROLS CO., FULTON SYLPHON DIV.*—Ralph A. Smith, chief materials and test engineer.

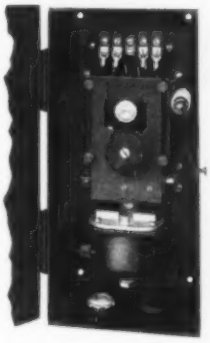
▸ *CENTURY ELECTRIC CO.*—H. George Nafe, manager of headquarters sales staff; Langdon C. Schaefer, manager of engineering.

▸ *ACME INDUSTRIES, INC.*—Ralph A. Wilkins, national service manager.

▸ *A. Y. McDONALD MFG. CO.*—D. E. Brubaker, advertising and sales promotion manager; E. J. Miquelon, assistant sales manager.

▸ *JOSEPH T. RYERSON & SON, INC.*—Theodore L. Kishbaugh, manager of Wallingford, Conn., plant.

MAINTAINS CONSTANT TEMPERATURE



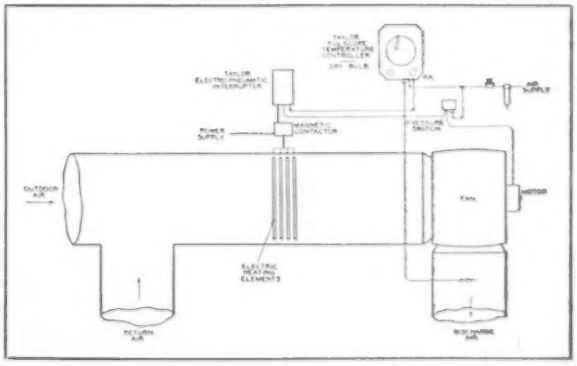
The Taylor Electro-Pneumatic Interrupter acts as a valve to proportion the flow of electrical energy on applications using electricity for heating.

This device makes it possible to maintain a constant temperature. And it eliminates the time lag often experienced on drying, space heating, and platen press applications by proportioning the electrical flow to the heaters.

It operates in conjunction with a FULSCOPE* Temperature Controller which sends an output pressure to the Interrupter's low pressure bellows unit. A plunger, on this unit, engages a micro-switch when there is a demand for heat. As the demand diminishes, the output pressure from the controller diminishes and the plunger of the bellows is fixed in such a position that the current "on" and "off" period is just sufficient to maintain a constant temperature.

Ask your Taylor Field Engineer or write for full details. Taylor Instrument Companies, Rochester, N.Y., and Toronto, Ontario.

*Reg. U.S. Pat. Off.



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or Subsidiary
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WHO'S WHAT

Continued

▸ *BRIDGEPORT BRASS CO.*—John H. Pimm, manager of plant soon to be constructed at Moultrie, Ga.; Douglas C. Graham, assistant sales manager of brass mill products; William Brown, sales manager of plumbing and heating division.

▸ *YORK DIV.* of *BORG-WARNER CORP.*—David D. Brenneman, production supervisor; C. B. Coombs, sales manager of "O. E. M." and "Mobile" products; Walter A. Kirchoff, Jr., merchandise manager, room air conditioners.

▸ *INTERNATIONAL BASIC ECONOMY CORP.*—Duane R. Branaka, sales manager of *SINCLAIR-COLLINS VALVE CO.* and *VALVAIR CORP.*

▸ *ROCKWELL MFG. CO.*—Ralph A. Purcelli, executive assistant to the general manager of Barberton, Ohio, plant.

▸ *WALWORTH CO.*—Elo Blomquist, manager of plastics division sales.

▸ *AMERICAN-STANDARD, DETROIT CONTROLS DIV.*—Frank Y. Carter, manager, market planning; Jack M. Strauss, product planning manager, air conditioning and refrigeration controls; A. C. Stein, product planning manager, heating controls.

▸ *INTERNATIONAL NICKEL CO., INC.*—John N. Ludwig, Jr., supervisor of metallurgical services.

▸ *A. W. CASH VALVE MFG. CORP.*—Bill Klein, manager of sales promotion and advertising.

▸ *DRAVO CORP.*—Charles E. Snyder, manager of heater sales for engineering works division.

▸ *KULJIAN CORP.*—William Mensing, advertising and public relations manager.

▸ *WEINMAN PUMP MFG. CO.*—Helge Victorsen, assistant chief engineer; J. M. Sperry, recently joined sales department.

▸ *WARREN PUMPS, INC.*—Frank A. Young, assistant chief reciprocating pump engineer; Richard J. Carroll, manager of field service; Peter W. Smallidge, assistant manager of field service.

WHO'S WHAT

Continued

▸ *LEHIGH MFG. CO.*—Richard F. Burke, national sales representative.

▸ *FEE & MASON MFG. CO., INC.*—Robert T. Maver, design engineer.

▸ *GENERAL ELECTRIC CO.*—Ralph W. Gustafson, manager of heating and special purpose controls product engineering.

▸ *A. M. BYERS CO.*—E. P. Best, director of metallurgy and research; T. D. Bonner, chief wrought iron metallurgist.

▸ *BOHN ALUMINUM & BRASS CORP.*—Wesley H. Markson, administrative sales manager; Donald J. Jessup, manager of unit department.

▸ *INSTITUTE OF HEATING & AIR CONDITIONING INDUSTRIES*—Clint A. Conatser, president of A. H. Conatser Heating and Air Conditioning Co., president; Gerson D. Ribnick, managing director.

▸ *CURTIS MFG. CO.*—Earl B. Boub, director of purchases in the St. Louis division.

▸ *KEASBEY & MATTISON CO.*—Robert E. Kennedy, personnel manager.

▸ *CUTLER-HAMMER, INC.*—Warren G. Cudlip, manager of quantity sales.

▸ *FRICK CO.*—David J. Wood, assistant sales manager.

▸ *INDUSTRIAL ACOUSTICS CO., INC.*—Daniel B. Callaway, supervisor of west coast activities.

IN THE TERRITORIES . . .

(Recent sales appointments)

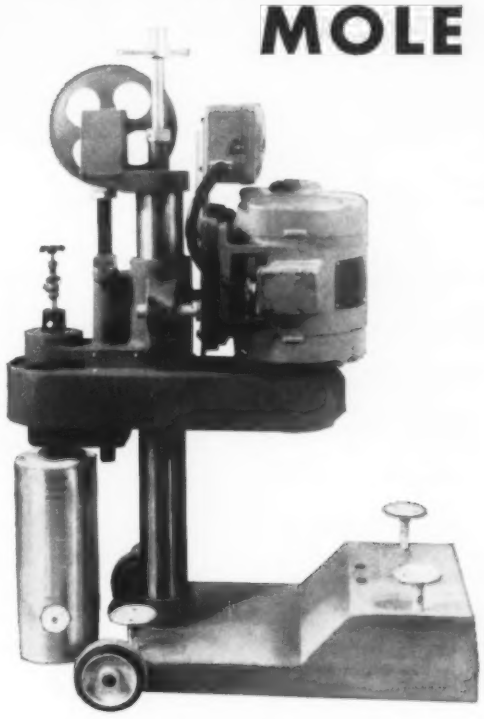
▸ *CONOFLOW CORP.*—Industra Co., Minneapolis, sales agent.

▸ *MUELLER BRASS CO.*—George Stucky, sales representative in Detroit office.

▸ *ATLAS VALVE CO.*—Victor J. Petervary, sales representative for northern New Jersey territory.

POWER + SPEED WITH THE

Model II MOLE



Drills through hard reinforced concrete where production jobs make you money. The extra power gives longer bit life.

3 H.P. Single Phase 110/220V. Electric Motor Max. Hole Size 6"
5 H.P. 3 Phase 220/440V. Electric Motor Max. Hole Size 8"

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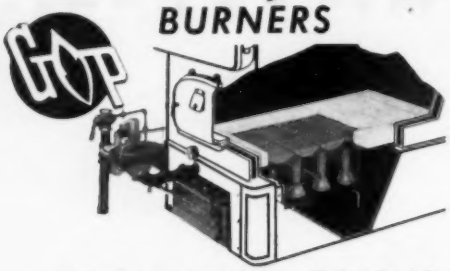
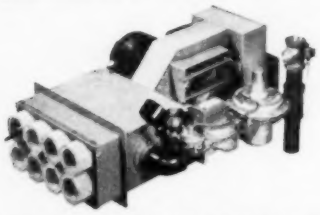
"Planned Performance"*
BURNERS



For heating and power boilers. 23 sizes listed in Catalog No. A-10.

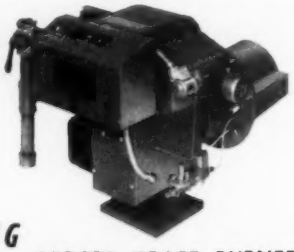
BLUE LINE UPSHOT ATMOSPHERIC GAS BURNER



Fully automatic, packaged assembly. Sizes listed to 28 million BTU/HR in Catalog C-10

TURBO-FIRE POWER TYPE GAS BURNER

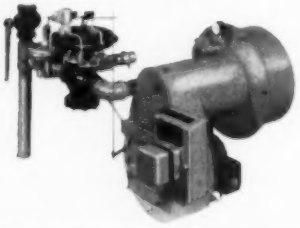
MODEL R
Capacities up to 2¼ million BTU/HR
Catalog E-61



TURBO-RING FORCED DRAFT BURNERS

Gas, oil, or combination Gas-Oil burner. No stack required on boilers equipped for pressure firing.

MODEL FGR
Capacities 1 to 9 million BTU/HR
Catalog E-51



* PLANNED — Factory assembled, pre-wired for "Bolt-in" installation.

* PERFORMANCE — Custom matched to individual boilers for quiet, efficient operation.

Gordon & Piatt also manufacturer of a complete line of domestic conversion burners plus large dual-fuel units. Write for literature and complete information.

Gordon & Piatt
P. O. Box 914
Winfield, Kansas

WHO'S WHAT

Continued

▸ *CARRIER CORP.*—Albert A. Giannini, assistant regional manager in northeastern United States; Maurice Merlin, Oliver A. Murphy, James P. McLaughlin, regional managers, contacting company's 70 representatives across the country; Noble Hirst, manager of technical services for application engineering group.

▸ *G. S. ZEIGLER & CO.*—Blake Equipment Corp., Englewood, N. J., agents for metropolitan New York and New Jersey.

▸ *WOLVERINE TUBE, DIV.* of *CALUMET & HECLA, INC.*—D. R. Frederick, sales representative in Birmingham, Ala., district; James R. Wicker, sales representative in Rochester office of New York district.

▸ *CONTROLS CO. OF AMERICA*—New distributors: Allied Electric Appliance Parts, Philadelphia, Pa.; M-G Electric Co., Birmingham, Ala.; Grant Sales Co., Minneapolis; United Radio, Inc., Cincinnati.

▸ *TRANE CO.*—Fred Manget, manager of Philadelphia sales office; Jack Renninger, manager of new Wilmington, Del., sales office; George Sheperd, manager of sales office in New Orleans.

▸ *NATIONAL CYLINDER GAS DIV.* of *CHEMETRON CORP.*—Clarence H. Reinecke, manager of Milwaukee district office.

▸ *OPW-JORDAN CORP.*—Marshall D. Payn, Rocky Mountain district manager.

▸ *A. W. CASH VALVE MFG. CORP.*—James A. Riordan Co. of Los Angeles, factory representative for California, Nevada and Arizona; Sales Engineers Ltd., Paramount, Calif., industrial factory representatives for southern California, Nevada and Arizona.

▸ *YOUNGSTOWN SHEET AND TUBE CO.*—Clarence E. Short, district sales manager in Minneapolis; Albert S. Harris, assistant manager, oil country tubular sales.

▸ *WORTHINGTON CORP.*—Warren Plumbing Supply Co., Detroit, distributor in eastern half of Michigan.

▸ *PARKER-HANNIFIN CORP.*—Robert B. Porter Co., Glendale, Calif., distributor for industrial "Gask-O-Seals" and "Stat-O-Seals."

WHO'S WHAT

Continued

▸ *DUNHAM-BUSH, INC.*—T. L. Joliat, sales engineer in the Detroit district office; Frederick Wenson, application engineer in the Detroit district office; Darrell Picht, salesman in Dallas area; Wittichen Supply Co., wholesaler in Birmingham, Ala., area.

▸ *WHITE-RODGERS CO.*—Leonard R. Wren, sales engineer Seattle sales area, including Washington, Idaho, western Montana and Alaska.

▸ *ALLIS-CHALMERS MFG. CO.*—Wayne R. Broaddus, Jr., sales representative for Atlanta, Ga., district; Joseph W. Hagan, sales representative for Birmingham, Ala., district; Lawrence R. Laffey, sales representative for Chicago district; Clyde A. Taylor and James R. Hodgson, sales representatives for St. Louis district.

▸ *CHRYSLER CORP., AIRTEMP DIV.*—E. D. Dickson, manager of central region, with headquarters in Dayton, Ohio; H. P. Young, manager of northeast region with headquarters in New York; G. B. Sharkey, manager of West Coast region with headquarters in Los Angeles.

▸ *MARLEY CO.*—R. S. Stover Co., Marshalltown, Iowa, sales representative in western Iowa, Nebraska, southeastern South Dakota.

▸ *A. M. BYERS CO.*—Robert L. Berwick, PVC plastic sales engineer in company's southeastern division with headquarters in Atlanta, Ga.

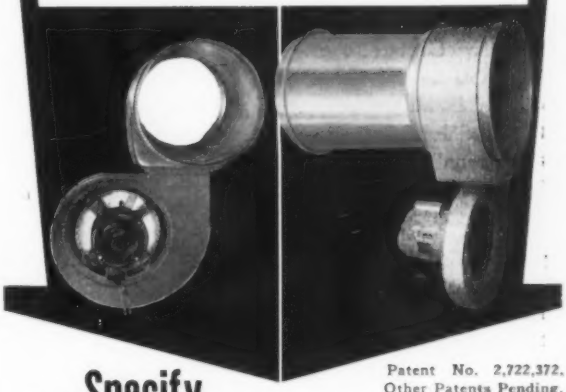
▸ *GRABLER MFG. CO.*—J. Patrick Dunlavy, manager of St. Louis branch.

▸ *NATIONAL SUPPLY CO.*—George N. Orbin, sales representative in Detroit; Lester H. Bennett, sales representative in New York; Gene A. Gallimore, sales representative in Houston.

▸ *RUBEROID CO.*—Frank J. Schmitt, Jr., sales manager of Dallas district.

▸ *McINTIRE CO.*—Changes in refrigeration division representation: Roy B. McCrady, now covering Iowa and Nebraska, in addition to his former territory; Carl Stewart, covering New York state, exclusive of New York City; Roy G. Trafton, sales representative in Arkansas, Louisiana, Mississippi and western Tennessee.

FOR LOW COST HEATING PLANT POWER-DRAFT AND INDUSTRIAL EXHAUSTING



Patent No. 2,722,372. Other Patents Pending.

...Specify

Quickdraft

★ NO MOTORS, FANS OR BEARINGS IN EXHAUST LINE ★ NEEDS NO STACKS ★ ACID RESISTING FINISHES ★ STATIC PRESSURE UP TO 60 INCHES

FOR HEATING PLANTS AND INCINERATORS, Quickdraft provides constant draft for efficient and economical combustion. It eliminates pulsating or chattering, puffing, smoking and sooting. Costly, tall and unsightly stacks are unnecessary.

FOR INDUSTRY, Quickdraft now offers from ¼-inch to 60-inches static pressure for exhausting corrosive gases, abrasives and paint spray . . . moving fine bulk materials and wastes.

FOR MOVING AIR . . . in or out of building through ducts . . . Quickdraft is outstanding.

N-648-QD

IMPORTANT NOTICE

For withstanding corrosive gases, all Quickdraft units are available in standard acid resisting vitreous enamel, No. 316 Stainless Steel, rigid plastics (P.V.C.) and with plastic and Fiberglas coatings.

Write for QUICKDRAFT ENGINEERING DATA on your application . . . today.

Quickdraft P. O. Box 87-K
CORPORATION Canton 1, Ohio

WHO'S WHAT

Continued

▸ *CENTURY ELECTRIC CO.*—F. L. Beattie, district manager of Milwaukee office.

▸ *E. I. du PONT de NEMOURS & CO.*—Herman Goldberg Co., Chicago, sales agent for "Freon" refrigerants in Indiana, Wisconsin, Minnesota, North Dakota, South Dakota, northern Illinois, eastern Iowa; Russell Sales Co., Santa Fe Springs, Calif., sales agent for "Freon" refrigerants in Arizona, California, Idaho, Nevada, Oregon, Utah, Washington.

▸ *CHASE BRASS & COPPER CO.*—Clifton D. McCarra, district manager of warehouse and office in Dallas; Howard N. Hartman, district manager at Philadelphia.

▸ *MUNDET CORK CORP.—DRAVO CORP.*, distributor for intermediate and high temperature insulation in pipe covering and block form.

▸ *WATTS REGULATOR CO.*—George Gilfeather, district sales representative in northern California and Nevada.

▸ *BABCOCK & WILCOX CO., TUBULAR PRODUCTS DIV.*—District sales office in Atlanta, Ga., moved to Room 464, Peachtree Bldg., 805 Peachtree St., N. E., Atlanta 8.

▸ *ILG ELECTRIC VENTILATING CO.*—R. M. Probizanski, joined New Orleans sales staff.

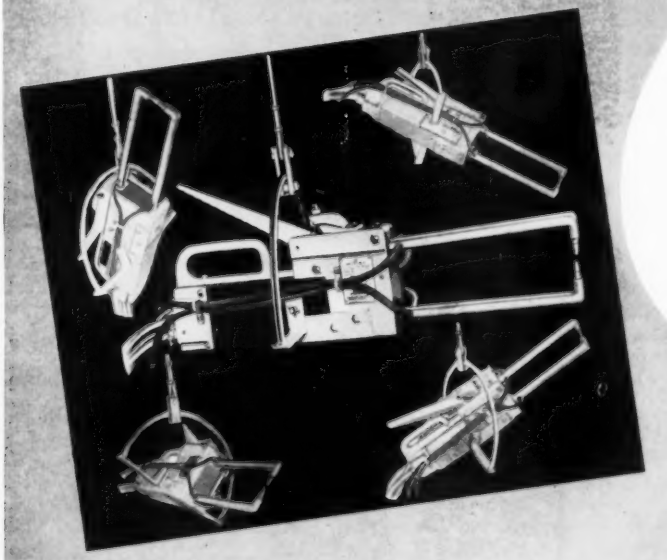
▸ *AMERICAN TUBE PRODUCTS, INC.*—Walter A. MacDougald, sales manager in lower New England and parts of New York state; Raymond M. Alden, sales manager in upper New England. ⫩

Obituary

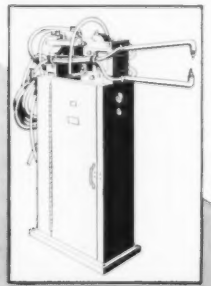
William Henry Neekamp

WILLIAM HENRY NEEKAMP, president of Vico Products, Inc., died suddenly at his home in Glastonbury, Conn., on March 1 at the age of 46. He was born July 24, 1912 in Ironton, Ohio. Previously he was sales manager of Universal Diffuser Corp. He is survived by his wife, a brother and a sister.

HANDY... any way you look at it



Ball bearing suspension ring takes all the weight and much of the work out of welding with a Miller MPS water-cooled portable spot welder. Choice of manual or air operated models, all with timers. 6" tongs secure work with pressure to 600 pounds. Model MPS-10-KVA weighs 79 lbs., welds up to 3/16" thickness; model MPS-20-KVA, 91 lbs., handles material to 1/4"; air operated models average 53 lbs. more. Wide choice of tongs.



Steel pedestals are available for both models.

miller ELECTRIC MANUFACTURING COMPANY, INC.

APPLETON, WISCONSIN

distributed in Canada by CANADIAN LIQUID AIR CO., LTD., Montreal

WE HEAR THAT . . .

▸ *SPORLAN VALVE CO.* officially opened its 25th anniversary year with a national sales meeting and company conference in St. Louis recently.

▸ *WALWORTH CO.* has announced that its subsidiary, *GROVE VALVE AND REGULATOR CO.*, will act as sales agent for specialized lubricated plug valve products to certain companies.

▸ *PENN CONTROLS, INC.* held a week-long sales conference recently. Sales personnel from all over the United States and Canada, as well as the corporation's export organization, discussed sales plans, techniques and objectives, markets, products and procedures.

▸ *CAMBRIDGE CORP.*, a wholly owned subsidiary of *CARRIER CORP.*, has been merged into the parent company. It is now a division known as *CAMBRIDGE CO.*

▸ *RELIANCE GAUGE COLUMN CO.* celebrates its 75th anniversary year during 1959.

▸ A class of 26 graduates of U. S. and Canadian colleges and universities has just completed *TRANE CO.*'s six month specialized post-graduate engineering program. It is designed to bridge the gap between scholastic background and assignment in the field.

▸ A new specialty blower division has just been formed by *TORRINGTON MFG. CO.* specifically for the design and manufacture of blowers for electronic cooling and other air and ground applications.

▸ "Operation Muscles," a $5 million plus expansion and modernization program of production facilities, has just been completed by *PERMAGLAS DIV.* of *A. O. SMITH CORP.* Included in the program are a $550,000 office addition, $115,000 warehouse, $105,000 research and test facility, modernization of existing manufacturing plants, and acquisition of a water softener plant in Omaha and a water heater production plant in another area.

▸ *BEAR MFG. CO.* recently purchased the *BALANCE ENGINEERING CO.* of Chicago.

▸ *ANSUL CHEMICAL CO.* has become nationwide sales agent for "Ucon" brand refrigerants, according to a joint announcement made by that company and *UNION CARBIDE CHEMICALS CO.*, the product manufacturer.

It's the . . . Sterlco®

THERMOTROL

for ACCURATE, INDEPENDENT ROOM TEMPERATURE CONTROL

STEAM or HOT WATER SYSTEMS

. . . for modernization or new construction

CAN BE KEY LOCKED

for . . .
HOSPITALS, APARTMENTS, OFFICES, HOTELS, SCHOOLS, MOTELS, INSTITUTIONS and PUBLIC BUILDINGS

- **COMPLETELY SELF-CONTAINED**
  Each Sterlco Thermotrol is a complete temperature control unit, easily installed in any two-pipe system in place of the manual valve. NO wiring or other external connections needed.
- **MODULATING CONTROL—NOT on AND off**
  Each Sterlco Thermotrol provides steady, even control to each radiator the way YOU want it. Radiators in cold spots give off heat while those in warmer parts of the same room are automatically throttled down.
- **NO ELECTRICAL CONNECTIONS**
  No electric wiring, additional piping, or other connections are required with the Sterlco Thermotrol. Just as easily installed for modernization as for new construction.

FOR BUILDING MODERNIZATION

With a Sterlco Thermotrol on each radiator, stuffy overheated rooms, open windows, and excessive fuel bills are eliminated. You pay for only the heat you need . . . rooms are comfortably, evenly warm . . . occupants comfortable.

FOR NEW CONSTRUCTION

Here's modern ZONE CONTROL for radiant systems. The only modern solution to inefficient "on-off" valves and expensive, motorized valves.

STEAM HEATING IS MODERN, EFFICIENT and DEPENDABLE
Sterlco Products Distributed through
LEADING HEATING and PLUMBING WHOLESALERS

STERLING, INC.
5202 W. Clinton Ave., Milwaukee 18, Wis.

CONDENSATION AND VACUUM PUMPS

HEATING SPECIALTIES

TEMPERATURE CONTROLS

Nothing but the best...

WESTERN ROTARY ROOF VENTILATORS with Lifetime Guaranteed BEARINGS

1. "Backward curved blower wheel" type mechanism assures high, constant exhaust capacity.
2. No backdraft, ever.
3. Unique factory lubricated sealed bearings are specially designed for positioning load, countering wind pressure, assuring stability.
4. Locked-on rotor, yet removable without special tools.
5. Exclusive Western corrugated vane increases rigidity.
6. Low, functional type adds beauty.
7. Aluminum, copper, or stainless steel construction available.
8. Baked enamel paint coating for beauty and long life.

Other type ventilators include:

- Stationary
- Directional
- Continuous ridge
- Vertical exhaust
- Axial roof
- Unit ventilators

Write for catalog and name of nearest representative.

WESTERN ENGINEERING AND MFG. CO.
4108 Glencoe Avenue, Venice, California

WE HEAR THAT

Continued

▸ Representatives from 27 states and Canada attended *INDUSTRIAL ACOUSTICS CO.*'s first national air conditioning sales conference at New York's Hotel Lexington recently. During the week-end conference, the representatives heard talks by the company's executives on the application of sound suppression to the air conditioning field.

▸ Approximately 400 architects, consulting engineers, plant engineers and contractors in the Chicago area visited an exhibit of the latest industrial, commercial and institutional air filtering, heating, ventilating and air conditioning equipment recently. The exhibit was sponsored by *AMERICAN AIR FILTER CO.* and was one of several meetings held throughout the U.S.

▸ Chicago offices of *J. O. ROSS ENGINEERING DIV., MIDLAND-ROSS CORP.* have been moved into the company's new surburban building at 370 S. School St., Mt Prospect, Ill. Engineers of the division recently held a two-day meeting in the new offices.

▸ *FOOD MACHINERY AND CHEMICAL CORP.* has acquired, subject to regulatory approval, the business of *J. S. COFFIN, JR., CO.* of Englewood, N. J., manufacturer of turbo-pumps for marine and industrial use.

▸ For the third consecutive year, *TRANE CO.* is offering up to eight $500 two-year pre-engineering scholarships to graduating high school seniors in the La Crosse, Wis., area.

▸ *BRIDGEPORT BRASS CO.* has announced plans to build a plant in Moultrie, Ga. The 65,000 sq ft plant and equipment will represent an investment in excess of $500,000.

▸ *AIR REDUCTION SALES CO., DIV.* of *AIR REDUCTION CO., INC.*, has announced the completion of a new manufacturing facility at 1100 Packard St., in Kansas City, Kans.

▸ Plans for constructing the largest single warehouse ever built at *ARMSTRONG CORK CO.*'s Millville, N.J., plant have been announced. The new warehouse will cover 86,000 sq ft of floor space and will bring to more than 210,000 sq ft the total warehouse space added to the plant in the past 30 months.

▸ The Decatur, Ill., works of *YORK DIV.* of *BORG-WARNER CORP.* recently went on a two-shift, six-day week operation.

WE HEAR THAT

Continued

▶ In its second expansion move in less than a year, *HUDIK-ROSS, INC.*, mechanical contractor, has leased new quarters for its New York office at 321 W. 44th St. The move triples the amount of space now occupied by the company in the city.

▶ *R. J. ULVESTAD* has been named top district sales manager of the *PERMAGLAS DIV.* of *A. O. SMITH CORP.* In special ceremonies, he was presented with a bronze plaque for "outstanding over-all achievement in the sale of Permaglas Div. products for 1957-1958." He received the award for his sales activities in the Rocky Mountain area district headquartered in Kansas City.

▶ A cross-country display of air conditioning, refrigeration and heating products, sponsored by *YORK DIV.* of *BORG-WARNER CORP.* was held recently at the Coliseum in Chicago. The display will also appear in St. Louis, Kansas City, Los Angeles, San Francisco, Dallas, Houston, Atlanta, Washington, D. C. and Boston.

▶ *SPANG-CHALFANT DIV.* of *NATIONAL SUPPLY CO.* has changed its name to *NATIONAL SUPPLY CO., TUBULAR DIV.*

▶ *ARKLA AIR CONDITIONING CORP.* has planned a series of gas air conditioner training schools during the remainder of the year, covering the subjects of maintenance, service, application engineering and sales.

▶ An award competition to honor the year's most significant advancement in the use, application, or metallurgy of copper, brass, bronze or other copper-base alloys has been announced by the *COPPER & BRASS RESEARCH ASSOCIATION.* Winner of the competition will receive $1000 and a bronze award to be presented at the association's annual meeting.

▶ *COMBUSTION ENGINEERING, INC.* has acquired *GENERAL NUCLEAR ENGINEERING CORP.* The company will be operated as a subsidiary.

▶ Last year the employees of *FRICK CO.* began a safety drive which carried them through a stretch of 1 million hours worked without a disabling injury, a new high in safety performance for the company. For this achievement, the Waynesboro manufacturing plant has earned the highest safety award of the Pennsylvania Manufacturers' Casualty Insurance Co. ≠

MERCOID

LOW PRESSURE CONTROL

FM APPROVED

GAS PRESSURE CONTROL

FOR GASES OR AIR

External adjustment

Visible calibrated dial

CAN BE USED THREE DIFFERENT WAYS

For operation as a

POSITIVE PRESSURE CONTROL
NEGATIVE PRESSURE (VACUUM) CONTROL

DIFFERENTIAL PRESSURE
(POSITIVE OR NEGATIVE PRESSURES)

This control employs a diaphragm which actuates a mechanism for opening or closing a mercury switch. The diaphragm separates two pressure chambers, one of which may be used for positive pressure; the other for negative (vacuum) operation or both chambers may be used to provide operation due to a difference in pressures between them.

OPERATING RANGE: 1.0" to 30.0" (H_2O)
MAXIMUM PRESSURE: 20 Psig

FIXED DIFFERENTIAL (SENSITIVITY)

When operating point is set at

LOW	MEDIUM	HIGH
0.6"	0.8"	1.0"

TYPES AVAILABLE

FULLY AUTOMATIC OPERATION: sp-st circuit opens on increase of pressure, vacuum or differential pressure; or sp-st circuit to open on decrease. (Available sp-dt or dp-st.)

SEMI-AUTOMATIC OPERATION (With Manual Reset): Available to operate automatically on decrease or increase.

FOR FURTHER DETAILS WRITE FOR BULLETIN PG

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4211 BELMONT AVE., CHICAGO 41, ILL.
NEW YORK OFFICE: 205 EAST 42nd ST.
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MEETINGS & CONVENTIONS

1959

APRIL 25-*MAY* 1—*Industrial Health Conference.* Sherman Hotel, Chicago. Industrial Medical Association, 28 E. Jackson Blvd., Chicago 4.

APRIL 28-*MAY* 1—*Mechanical Contractors Association of America,* 70th annual convention. Shoreham Hotel, Washington, D. C. Mechanical Contractors Association of America, 45 Rockefeller Plaza, Suite 570, New York 20.

APRIL 28-*MAY* 3—*U. S. Consulting Engineers Council,* annual general meeting. Biltmore Hotel, New York. Consulting Engineers Council, 326 Reisch Bldg., Springfield, Ill.

APRIL 28-*MAY* 3—*Oil-Heat Institute of America, Inc.,* annual convention. Seattle, Wash. Oil-Heat Institute of America, Inc., 500 Fifth Ave., New York 36.

MAY 4-6—*Construction Specifications Institute,* annual convention. Palmer House, Chicago. Construction Specifications Institute, 1520 18th St., N. W., Washington 6, D. C.

MAY 25-29—*National Fire Protection Association,* annual meeting, Atlantic City, N. J. National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

JUNE 1-4—*National District Heating Association,* 50th golden anniversary meeting. Skytop Club, Skytop, Pa. Information: John F. Collins, Jr., 827 N. Euclid Ave., Pittsburgh 6.

JUNE 1-5—*AGA Gas Air Conditioning Sales School,* Baker Hotel, Dallas. Information: Arthur Q. Smith, Public Information Bureau, American Gas Association, 420 Lexington Ave., New York 17.

JUNE 14-19—*Electrical Precipitation Seminar,* Pennsylvania State University. Information: Extension Conference Center, The Pennsylvania State University, University Park, Pa.

JUNE 21-26—*American Society for Testing Materials,* annual meeting. Chalfonte-Haddon Hall, Atlantic City, N. J. American Society for Testing Materials, 1916 Race St., Philadelphia 3.

JUNE 22-24—*American Society of Heating, Re-*

RAYPAK *gas-fired copper tube boilers*

20 Year Guarantee

(ON CENTRAL HEATING SYSTEMS.)

APPROVED BY A.G.A.

A.S.M.E. CODE INSPECTED AND STAMPED

At least a score of years of sound performance may now be added to the efficiency, economy of installation, copper and bronze waterways and many other advantages enjoyed by users of Raypak boilers on hydronic systems.

Raypak's fabulous stainless steel burners and gas modulation systems combined with the above make Raypak hot water boilers superior - - - BY FAR.

MEMBER BETTER HEATING- COOLING COUNCIL

Raypak® COMPANY, INC.

Engineers-Manufacturers

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DO YOU FIND YOUR PUMP PROBLEM HERE?

A
- Water Supply
- Air Conditioning
- Refrigeration
- Cooling Towers
- Sump Pumping, Etc.

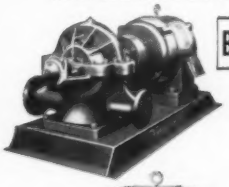
B
- Booster Service
- Cooling Towers
- Water Treatment
- Water Circulation
- Brine Service, Etc.

C
- Hot Water Circulation
- Ice Water or Brine
- Clear Water
- Boilers
- Booster Service, Etc.

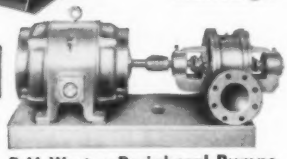
D
- Hot and Cold Liquids
- Refrigerants
- Boiler Feed
- Cooling Towers

Then You'll Find Your Best Answer Here—

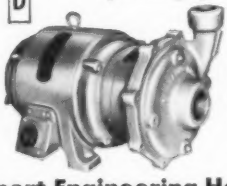
A **F-M Pomona Water-Lubricated Turbine Pumps**
Easily installed, easy to adjust for varying field conditions. Available with wide choice of drivers.



B **F-M Split-Case Centrifugal Pumps**
Capacities, pressures and sizes for any requirements. Single-stage or multistage.



C **F-M Westco Peripheral Pumps**
Capacities to 200 gpm. Pressures to 900 ft. Sizes 1½" through 2½". Horizontal single-stage or multistage. Develops high pressure at normal operating speeds.



D **F-M Builtogether Centrifugal Pumps**
Capacities to 900 gpm. Pressures to 525 ft. Sizes ¾" through 5". Single-stage or multistage.

FREE! Expert Engineering Help at Your Service

Be *sure* of low-cost, foolproof pumping installations that match your exact requirements...call in your Fairbanks-Morse Sales Engineer. Take advantage of his broad technical background and expert knowledge of pumps for air conditioning, plumbing and heating. Call him today, or write Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Illinois.

See Sweet's Product Design Catalog File for complete F-M Pump Line.

FAIRBANKS-MORSE
a name worth remembering when you want the BEST

PUMPS • SCALES • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY
RAIL CARS • HOME WATER SERVICE EQUIPMENT • MAGNETOS

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this **WALKER SHUR-FLO** Draft Inducer-Regulator *Unit...*

ENDS DRAFT PROBLEMS RIGHT FROM THE START...

MODELS For Gas...Oil...and Solid Fuels!

THE INSIDE STORY OF SHUR-FLO EFFICIENCY

- Hi Volume Self-Feathering Fan
- Self-Cleaning Blades (No soot build-up)
- Stainless Steel Shaft, Hub, and Blades.
- Quiet, burn-out proof motor
- Silicone oiled bearings
- Extra rigid mountings.
- Extra heavy gauge galv. steel construction.

"I don't fuss and fret with uncertain draft anymore since Walker brought out this low-priced draft inducer-regulator combination. Now, I install Walker inducers on all my jobs. That puts me way out ahead, because with good draft I know every job will be exactly right from the start."

"Most Efficient Draft System Ever Made"

Say Heating Contractors, Architects, Home Owners

Draft problems are eliminated with a Walker Shur-Flo Control (Pats. Pending) in an oil, coal, or gas-fired installation because it's the SUREST DRAFT SYSTEM ever devised.

Here's an economical draft inducer that's a fool-proof answer to every draft problem from older heating installations to modern, low-roofed houses. You just install it and forget it. What could be better?

Moreover, the Walker Shur-Flo with fan operated draft inducer moves ONLY flue gases; does not suck in outside air. Building and home owners like the Shur-Flo because it runs quietly, costs less to operate, and requires little power. You'll like the Shur-Flo because it installs quickly at any angle—vertically, horizontally, or at a pitch—and virtually eliminates costly callbacks and corrections.

There's a Walker Draft Control scientifically designed to meet every draft problem regardless of fuel. 28,000,000 in use prove efficiency. The standard of performance for the industry.

ROYAL PURPLE for smaller central heating plants

JUNIOR LINE central heating budget control

DOUBLE SWING for gas fired equipment

VENTURI CAP for heating and ventilating

For full details, see your supplier or write direct

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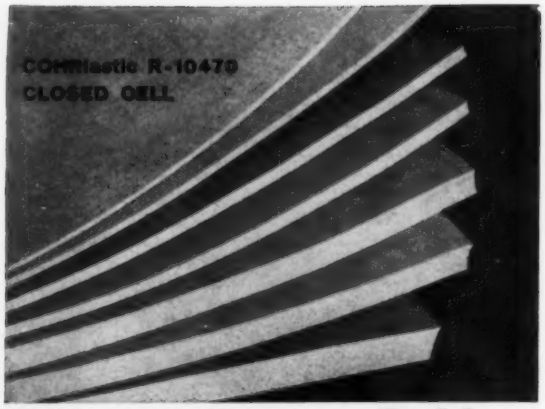

Silicone Sponge Rubber

flexible at temperatures —100°F to 500°F

COHRlastic R-10470 has a dense, uniform, non-absorbing closed cell structure, highly suitable for soft gasketing, vibration dampening, fairing strips, pads, cushions and other applications where resiliency at extreme temperatures is required. It may be bonded to metals, plastics, fabrics or silicone rubber. Possesses superior compression set resistance, excellent dielectric properties, immunity to aging, ozone and weather hardening. Available from stock in 24" x 24" sheets —1/16" through 1/2". Special sizes and extruded shapes made to order.

FREE SAMPLES and folder — write, phone or use inquiry service.

CHR PRODUCTS: COHRlastic Aircraft Products — *seals, coated fabrics, and ducts;* COHRlastic Silicone Rubber Products — *moldings and extrusions, sheets and sponge;* Temp-R-Tape — *pressure sensitive, thermal curing Teflon and silicone tapes;* Allied Products — *COHRlastic silicone cements and conductive gasketing.*

CHR CONNECTICUT HARD RUBBER

Main Office: New Haven 9, Connecticut

efficiency

Reznor gas unit heaters react instantly, automatically to the requirements of their immediate surroundings . . . producing and distributing heat right when and where it's needed. There's no costly stand-by firing of boilers, no heat lost in transmission. Reznor heaters give your clients a full dollar's worth of heat for every dollar's worth of fuel consumed.

EFFICIENCY makes these completely-automatic packaged units the ideal way to heat a wide variety of commercial and industrial buildings. Ask your Reznor distributor for the complete story or write for your free copy of "Modern Heating".

Look for Reznor under "Heaters-Unit" in the Yellow Pages

REZNOR

WORLD'S LARGEST SELLING DIRECT-FIRED

UNIT HEATERS

Reznor Manufacturing Company, 51 Union Street, Mercer, Pa.

MEETINGS & CONVENTIONS

Continued

1959

frigerating and Air Conditioning Engineers, annual meeting. Lake Placid Club, Lake Placid, N. Y., American Society of Heating, Refrigerating & Air-Conditioning Engineers, 62 Worth St., New York 13.

JUNE 22-26—*Air Pollution Control Association,* annual meeting, with technical sessions and exhibits. Hotel Statler, Los Angeles. Air Pollution Control Association, 4400 Fifth Ave., Pittsburgh 13.

JUNE 22-26—*Short Course in Corrosion Reactions and Corrosion Control.* Massachusetts Institute of Technology, Cambridge, Mass. Presented in cooperation with the National Association of Corrosion Engineers. James M. Austin, Director of Summer Session, Massachusetts Institute of Technology, Cambridge 39, Mass.

SEPT. 21-25—*Instrument Society of America,* instrument-automation conference and exhibit. International Amphitheater, Chicago. For information contact: Fred J. Tabery, exhibit manager, Instrument-Automation Conference and Exhibit, 3443 S. Hill St., Los Angeles 7.

OCT. 5-7—*American Gas Association,* annual convention. Conrad Hilton Hotel, Chicago. American Gas Association, 420 Lexington Ave., New York 17.

NOV. 2-5—*Air Conditioning and Refrigeration Institute,* 11th exposition. Atlantic City Auditorium, Atlantic City, N. J. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C.

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FEB. 1-4—*2nd Southwest Heating and Air Conditioning Exposition.* Memorial Auditorium, Dallas. Under auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, in conjunction with the newly merged society's semi-annual meeting, also in Dallas. For information contact: International Exposition Co., 480 Lexington Ave., New York 17. ASHRAE headquarters: 62 Worth St., New York.

MARCH 14-18—1960 *Corrosion Show.* Memorial Auditorium, Dallas. Under the auspices and in conjunction with annual conference of the National Association of Corrosion Engineers. Information: R. W. Huff, Jr., Exhibition Manager, 1061 M & M Bldg., Houston 2. ⧺

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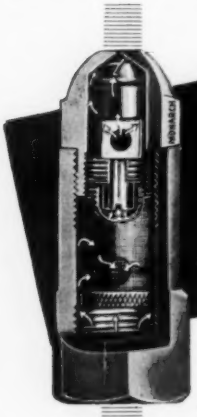

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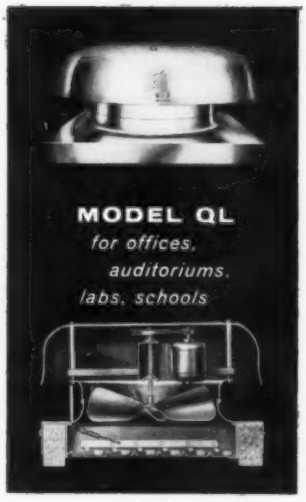

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SELECTED BIBLIOGRAPHY ON BUILDING CONSTRUCTION AND MAINTENANCE, Building Materials and Structures Report 140—By Edith R. Meggers. 30 pp. Available from: Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. 25c.

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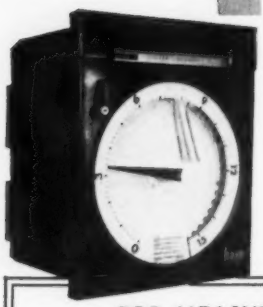

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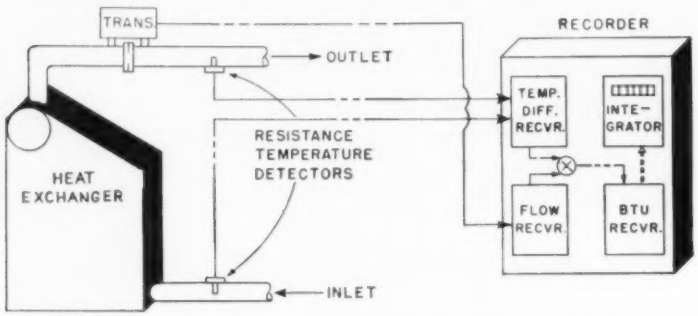

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FACT: 400 corrosion resistance ratings are available for Byers PVC Pipe

The ability of Byers PVC Pipe to handle various corrosive media is down in black and white. There are a number of tables available from Byers Engineering Service Department listing corrosion resistance ratings. Actual laboratory tests helped to determine these ratings. And we present them on a comparative basis with several metallic pipe materials.

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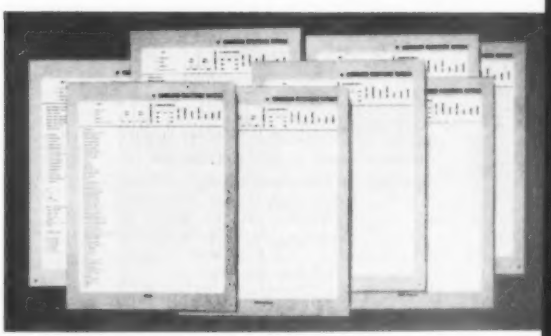

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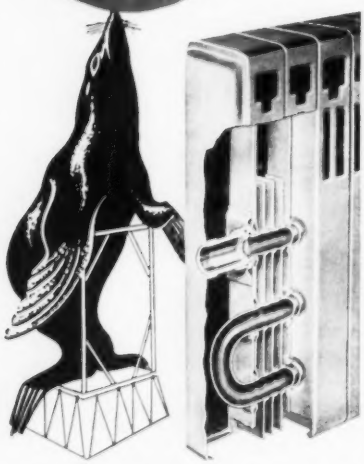

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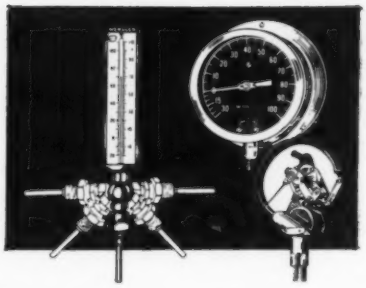

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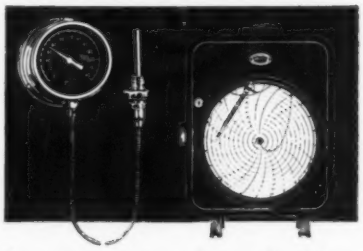

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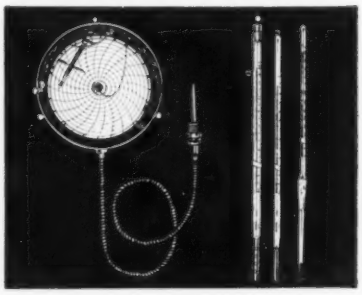

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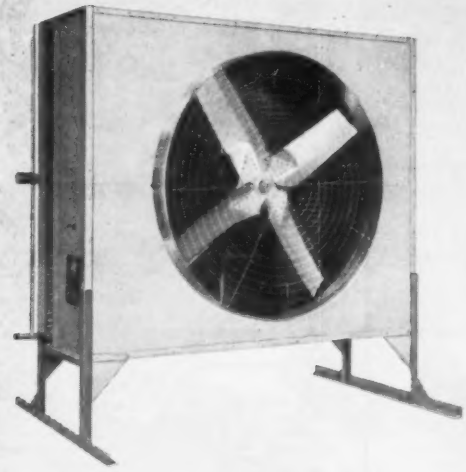

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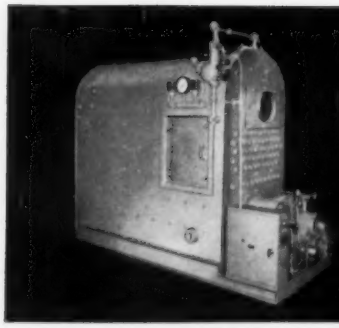

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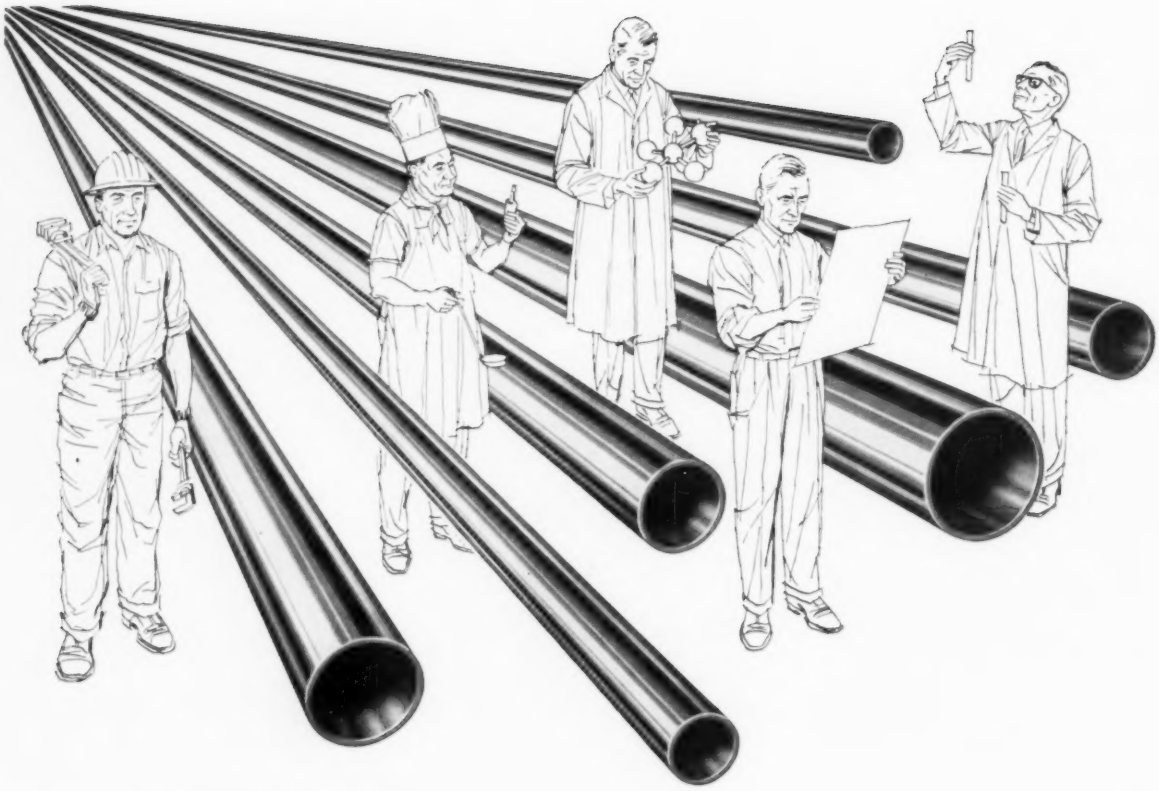

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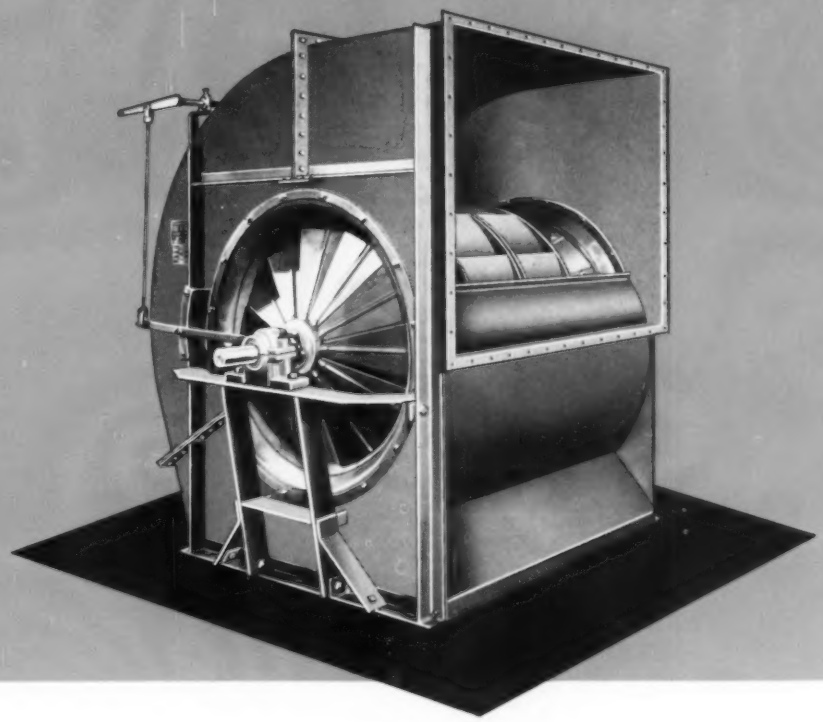

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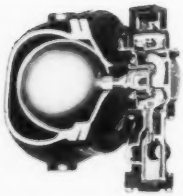

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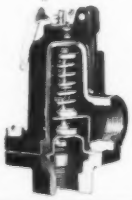

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